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These latter were made the subject of a communication by Messrs. E. Desor and E. C. Cabot as far back as 1849,* and an abstract of the same by Mr. A. S. Packard appeared in 1866,† while in 1875 a more extended account was published by Messrs. S. H. Scudder and A. E. Verrill.‡ In this latter paper more than fifty molluscs, besides several bryozoöns, crustaceans and echinoderms, are enumerated as having been found there. It is evident that there must have been a far better exposure of the strata when these accounts were written than exists at the present time. Thus the section as described by Desor and Cabot consisted of a bed of brown clay at the base, about twenty feet in thickness, over which were some sixty-five feet of stratified sands and gravèls with peat and dune sand on the surface. Scudder also gives the same general description of the section, while in Shaler's report he notes the changes which have taken place in recent years, the formation of a wide beach and the masking of the base by a talus upon which a considerable growth of vegetation has taken hold, resulting in the complete obliteration of all trace of the clay.

At the time of my visit I searched for a long time before I could find any indications of a shell bed, but finally discovered an exposure about a quarter of a mile south of Sankaty Head lighthouse. It was so mixed up in the talus that its limits, especially in the lower part, were impossible to define, but I judged that the upper limit was about twenty feet above high water level and extended laterally only for a distance of some fifteen feet. The deposit had more the appearance of a pocket than a layer. Two hundred and sixty-one specimens, good, bad and indifferent, were collected, of which two hundred and five are *Ostrea*, *Arca* (*Scapharca*), *Serpula and Venus*, and of these a much larger number could have been gathered.

Following is a complete list, for verifications in which I am indebted to Professor R. P. Whitfield, of the American Museum of Natural History:

MOLLUSCA.

Buccinum undatum Linné. (Fragmentary.)
Ilyanassa obsoleta (Say.) Stimp.
Crepidula sp? (Fragmentary.)

* On the Tertiary and more recent deposits in the Island of Nantucket. Quart. Journ. Geol. Soc., London, V. (1849) Proc. p. 340; also referred to in Proc. Boston Soc. Nat. Hist., III. (1848) 79, and Am. Journ. Sci., XIV. (1852), 51.

† Mem. Boston Soc. Nat. Hist. I. (1866), 252.

‡ On the Post-Pliocene fossils of Sankoty Head, Nantucket Island; by A. E. Verrill; with a Note on the geology; by S. H. Scudder, Am. Journ. Sci., X. (1875), 364-375.

Crucibulum striatum (Say.) H. & A. Ad.
Panopæa sp? (Fragmentary.)
Mesodesma Jauresi Joan.
Venus mercenaria Linné.
Venericardia borealis (Conr.) Carp.
Astarte undata Gould.
Arca (*Scapharca*) *transversa* Ad.
Modiola sp? (Fragmentary.)
Ostrea Virginiana (Lister.) Fav.

CRUSTACEA. ANNELIDA. BRYOZOA. PORIFERA.

Balanus eburneus Gould.
Balanus porcatus Costa. (Separate pieces only.)
Serpula (*Hydroides*) *dianthus* Ver. (Many specimens covered with a bryozoön—*Escharina Isabelliana* D' Orb?)
Cliona sulphurea (Desor.) Ver. (Represented by borings, especially in the shells of *Ostrea* and *Arca*.

Except in the case of *Panopæa* and *Mesodesma* this list adds nothing new to the previously published fauna of the shell bed, but continuous records of collections from the locality are of value and doubtless occasional new species will turn up whenever the material in the bed is carefully examined.

The most interesting and unexpected find was a fragment of silicified wood in the talus near the foot of the bluff, about a quarter of a mile east of the lighthouse. A superficial examination in the field led me to think that it must be a piece of palm wood. Subsequently sections were prepared for microscopic examination, but the tissues were found to be too imperfectly preserved for specific determination. They were submitted to Dr. C. C. Curtis, of Columbia College, and to Dr. F. H. Knowlton, of the United States Geological Survey. Dr. Curtis recognized the endogenous structure, without, however, deciding it to be palm wood. Dr. Knowlton considered it undoubtedly to represent a palm. I was unable to satisfy myself that it was either the same as or different from certain species of *Palmoxylon* * previously described. The only ones reported from the Eastern United States, however, were found in the

* *Palmoxylon* Schenk, Engl. Bot. Jahrb. III. (1882) 486. A generic term used to designate fossil palm wood.

*Diorite.**—The massive moraines on the eastern side of Muir glacier are made up in the main of fragments of a quartz free diorite, which is a more basic rock than the quartz diorite. Numerous blocks of hornblendic gneiss and schist also occur, which may represent foliated phases of this diorite. The large content of such rocks in the moraines leading from the valleys occupied by the McBride, Casement and Girdled glaciers and Berg lake, and from Granite cañon, shows that the enclosing mountains are in great part of diorite, and the color and aspect of these mountains when viewed from a distance give evidence to the same effect. None of these mountains have been reached by parties exploring Muir glacier, so that the nature of the argillite-diorite contact is unknown. But there is a total absence of anything indicating shore conditions as this contact is approached; no pieces of conglomerate have been noted on the moraines, and pieces of fine grained diorite, evidently from dikes, have been found. The diorite is therefore likely to prove of later date than the Carboniferous sediments. So far as known it shows no tendency to grade into the quartz-diorite. They may represent phases of the same intrusion, or different intrusions from the same magma.

Crystalline Schists.—In the collection of rocks made by Dr. Reid in 1892 are specimens of mica schist and actinolite schist, obtained from erratic blocks on the west shore of Glacier Bay, mainly at the northwest corner of Hugh Miller inlet and at the eastern side of the entrance to Geikie inlet. It is of the highest degree of probability that these erratics were brought hither by the glaciers which at present debouch into these inlets, and that therefore outcrops of these schists lie in that direction. Dawson reports frequent areas of schists and gneisses as occurring in the Coast range granite belt, and quite subordinate to the granite in amount, and these may have come from such patches. On the other hand, granites are not represented in Dr. Reid's collection.

Megascopically, the mica schists are finely granular, very schistose rocks with abundant biotite, all of which carry small garnets, and some contain staurolite in addition. Except in the size of the garnets, they precisely resemble the well-known garnetiferous mica schist from the mouth of the Stikine river. The actinolite schists are finely fibrous green schists, mainly composed of actinolite.

Dikes.—All the rocks so far described are cut by numerous dikes, of varying nature but largely of diabase. They are not only younger than the other rocks, but also younger than the

* G. H. Williams, Nat. Geog. Mag., Vol. IV., pp. 65-67.

time of disturbance and metamorphism of these rocks. In thin section they show no sign of having suffered from the dynamic action which has so profoundly affected the other rocks and whose effect is so beautifully shown in sections of the diorites by the bent and broken crystals, undulatory extinction and production of secondary minerals there exhibited.

While in the main to be classed as diabsses, these dikes shade into andesite-like rocks through loss of the ophitic structure and development of a glassy groundmass. Specimens of more acid rock, rhyolites and micro-pegmatites, are not infrequent on the moraines, but only one such dike has been found in place, and no evidence is at hand as to their relation in time to the basic dikes. These dike rocks much resemble others of known Tertiary age occurring further to the south.*

Comparison With Other Alaskan Sections.

The Coast range belt, of which the region under consideration is structurally a portion, is shut away from the Pacific. north of Cross sound, by the lofty peaks of the Fairweather range. If, as seems probable, this latter belongs structurally with the St. Elias range, it is of a much more recent date.† The Glacier bay section presents many points of similarity with sections described by Dawson and Hayes from British Columbia and southern Alaska, so that a rough correlation may be attempted. A marked feature here is a limestone of great thickness, which, at least in part, is of Carboniferous age. Dawson describes such a limestone from the Dease river holding Fusulina,‡ and another from his section along the Stikine which he believes the same, though finding no fossils.§ Apparently the same limestone is mentioned by Hayes as occurring in the Taku valley.‖ Furthermore Hayes reports black slaty shales apparently underlying the limestone, and Dawson describes from the Stikine a series of "hard argillites and grauwacke-quartzites, interbedded with shaly gray and brownish impure limestones," which were "not observed to hold staurolite, mica, or otherwise crystalline minerals like those of Wrangell, and otherwise differ somewhat in appearance from those."¶ These rocks are below

*For brief petrographic descriptions of specimens from these dikes see G. H. Williams, Nat. Geog. Mag., Vol. IV., pp. 68-74.

†See. H. F. Reid, Nat. Geog. Mag., Vol. IV, p. 24, and G. F. Dawson, Geol. Surv. Can. An. Rep. 1887-8, p. 12 B.

‡G. F. Dawson, Geol. Surv. Can. An. Rep. 1887-8, p. 33 B.

§G. F. Dawson, Geog. Surv. Can. An. Rep. 1887-8, p. 55.

‖C. W. Hayes, Nat. Geog. Mag., Vol. IV., p. 138.

¶Geol. Surv. Can. An. Rep. 1887-8, p. 55 B.

Choctaw, Oklahoma and Gulf railway, where he succeeded in working out the succession. His section is as follows:*

Poteau Stage.

1.	Sandstones and shales	1200′
2.	*Kavanaugh coal bed*	4′
3.	Sandstones and shales	4036′
4.	*Secor coal bed*	2′ 6″
5.	Shale	30′

Tomlinson Stage.

6.	Sandstone	50′
7.	Shales	320′
8.	Sandstones	100′
9.	Shales with *coal*, 3′ near bottom	220′

Norristown Stage.

10.	Sandstone	100′

Booneville Stage.

12.	Shales	200′
13.	Sandstone	50′
14.	Shales	130′
15.	*Norman coal bed*	3′
16.	Shales and sandstones, thin coals	600′
17.	*McAlester coal bed*	4′
18.	Shales	500′
19.	Sandstone	100′
20.	Shales with thin coals	700′
21.	*Grady coal bed*	4′

Appleton Stage.

22.	Sandstone, Cross Plains	200′
23.	Shales, not measured.	

Below the shales Dr. Chance found a limestone which he was inclined to regard as possibly Lower Carboniferous.

The highest beds of the column are reached on Kavanaugh and Sugar Loaf mountains, in the Sugar Loaf synclinal of Winslow, which holds the *Huntingdon coal* of Arkansas. Dr. Chance's section evidently reaches higher beds than are found in Arkansas, but it is possible that the thickness may be exaggerated somewhat, as there was no opportunity to check the observations by means of borings. The coal bed, termed by him the *Kavanaugh*, or *Mayberry*, is of indifferent character, and consists of

*The parallelisms with the Arkansas section are by the writer, and Dr. Chance must not be regarded as responsible for them.

alternations of shale and coal, in all from 3′ 6″ to 5′ 1″ thick. It is evidently one of the higher coal beds found within the Poteau shales in Arkansas. Possibly the bed worked formerly at Poteau station in that synclinal, may be the same with the *Huntingdon coal bed*. But this is only a conjecture, as the beds were not traced.

The Greenwood sandstone of the Sebastian stage could not be recognized on the southerly side of the Sugar Loaf synclinal, there being more than one sandstone which would meet the requirements, and the equivalent of that bed can be determined only by direct tracing from the typical locality in Arkansas, there being no limestones or other definite horizons to save one that labor. The line between the Poteau and Sebastian is drawn arbitrarily.

The Booneville Stage is that of most interest in the Indian Territory and is exposed in a series of narrow, rudely east and west synclines from the Arkansas line and along the Choctaw, Colorado and Gulf railroad to beyond McAlester, on the Missouri, Kansas and Texas railway. Dr. Chance's study of this division was especially detailed and satisfactory. Since his investigations, in 1890, the beds nave been traced eastward from the Choctaw road to the Arkansas line and extensive mining operations h: ve been carried on in the Territory, but all recent investigations tend only to confirm the accuracy of his work.* The Booneville consists of a great mass of shale with beds of sandstone from 50 to 150 feet thick, which form bold ridges, by means of which the coal beds can be traced. Eleven coal beds occur in this series, only two of which have been found economically important. The *Grady coal bed* is at the base of the division, separated by only a few feet, rarely more that forty, from what the writer takes to be the Cross Plains sandstone. It appears to be comparatively unimportant near the Missouri, Kansas and Texas road, but increases in importance eastward and is mined at Hartshorne, in what is known as the Grady basin, and on the St. Louis and San Francisco railroad, at the Bryan mine. It has been traced and proved by prospect holes into Arkansas, where it is shown on the southerly side of Poteau mountain. Its thickness near Hartshorne is from 3′ 6″ to somewhat more than 4′, and the coal is of excellent quality, being clean and bearing handling well. It cokes readily, but no effort has been made to utilize it in that manufacture.

* I am under very decided obligations to Mr. Francis I. Gowen, President of t h Choctaw, Oklahoma and Gulf railroad, and to Mr. Edwin Ludlow, General Superintendent of Mines, as well as to Dr. E. N. Wright, of Atoka, for material assistance and for many courtesies while in the Indian Territory. Also to Dr. Chance, who has given me the use of his notes.

Territory, and have recognized the similarity of its structure to that of the Appalachian chain; but while the similarity has been recognized, a notable contrast has been observed, the trend of the Ouachita being approximately east and west, while that of the Appalachian is approximately north and south.

The similarity is indeed very striking, but the contrast is far from being so important as might be imagined at the first glance. The Appalachian type of structure is especially distinct to some distance west from the Missouri, Kansas and Texas railroad. Overlapping anticlines and synclines are numerous, so that the coals in the Choctaw nation are found in basins and the sandstone outcrops follow zigzag lines. The conditions are not so prominently distinct beyond that railroad and southward from the latitude of McAlester, as the region has been base-leveled, and the folds, being less prominent, have less influence on the topography; but the conditions can be traced out without difficulty for many miles southward.

The resemblance to the Appalachian structure, however, is not confined to the overlapping anticlines and synclines; it is equally marked in variation of the trend. At Wilburton, on the Choctaw, Oklahoma and Gulf railroad, about 60 miles west from the Arkansas line, the main trend as shown by the Limestone Hills, is bent south of west, then southwest, and this latter course is held for about 45 miles to Limestone Gap, where it is changed to west of south. This direction continues for 20 miles as followed by the writer, and Prof. Hill appears to have traced it for probably 10 miles more, thus giving about 75 miles for the southerly trend. How much further this course is held cannot be determined, for at a little distance further one comes to the Cretaceous overlap, marked out by Prof. Hill, which conceals the older structure. The Ouachita system, as a topographical feature at least, seems to have its eastern limit not far from Little Rock, Arkansas. The westward trend extends thence to near Wilburton, on the Choctaw railroad in Indian territory, about 140 miles in a direct line; thence the southerly trend continues for not less than 75 miles or somewhat more than one-half of the other.

This is precisely the type of variation shown by the Appalachian trend in Pennsylvania and Virginia. From the Schuylkill river to southern Perry County in the former State, about 90 miles in direct line, the course is south of west; abruptly changing, it becomes west of south and so continues for about 250 miles to near New River, Virginia, where it again becomes south of west, which direction is maintained for about 100 miles, to a short distance beyond the Tennessee line. The sweep of

trend in each case is quite as sharp as that of the Limestone Hills* in the Choctaw nation. This similarity is so striking that one is tempted to imagine that the Ouachita folds within Arkansas, when followed out in detail, may be found to show a northward bend in their trend and may prove to be connected with some system of folds in Missouri, so that the Ouachita may resemble the Appalachian in a general northeastward and southwestward trend, but with the east and west portions possibly longer than the north and south.

Thus far no reference has been made to the granitic area and the Arbuckle mountains west from the Missouri, Kansas and Texas railroad in the Chickasaw nation. The writer had no opportunity to examine any except the western portion of that region. He is inclined, however, to regard it as belonging to an older system of folds and as wholly independent of the Ouachita, its peculiar structure and singular complexity being in striking contrast to the beautiful simplicity of the Ouachita. Undoubtedly it was affected by the post-Carboniferous elevation of the latter system, to which much of the distortion of dips may be due. To the same cause, indeed, may be attributed the contradictory dips and trends exhibited by the Carboniferous rocks near Dougherty, on the Santa Fé railroad.

The Chickasaw region between the Missouri, Kansas and Texas, and the Gulf, Colorado and Santa Fé railroads deserves careful investigation. The only examination, thus far made, is the reconnaissance by Prof. Hill, which, considering the difficulties under which it was made, was singularly fruitful in results

The second paper of the evening was read by Prof. J. F. Kemp, "Zinc and Lead Mines in Southwestern Virginia."

The paper was based upon a visit of the speaker to the mines the past summer. It showed their geographical distribution and the general geology of the country. By means of lantern views from photographs taken on the spot, the excessive subaerial decay of the blende bearing limestones was made clear, and the occurrence of the zinc in the shape of calamine as crusts upon the decomposed limestone and beneath the overlying mantle of clay. It was stated that the chemical reaction which had lead to the formation of the ore must have taken place at the ordinary temperature, and owing to the influence of the

*These have been selected as they are the special topographic feature of the region The structure is shown equally well by other members of the section, of course.

common agents, such as carbonated atmospheric waters, sulphuric acid and sulphate of zinc, produced by the decay of the blende and from the action of the silica in the original limestone. The speaker did not attempt to illustrate the matter further, but cited it as an interesting subject for experiment and investigation. The paper was illustrated with numerous specimens and with the lantern. Discussion by the Chairman and others followed.

The Academy then adjourned.

J. F. KEMP, *Secretary.*

PUBLIC LECTURE.

November 25th, 1895.

The first public lecture of the course of 1895–6 was delivered at the Law School of Columbia College by Mr. Cornelius Van Brunt, on "The Natural Flora of Bronx Park."

The lecturer only treated of the flowering plants. His remarks were illustrated by a large series of beautifully colored lantern slides, and was of especial interest on account of the close association of the Academy with the newly organized New York Botanical Garden, which will occupy Bronx Park.

About 150 people were present.

J. F. KEMP, *Secretary.*

STATED MEETING.

December 2d, 1895.

The meeting was called to order, President Rees, in the chair. There were about twenty-five members and guests present.

In the absence of the Secretary, W. Hallock was appointed Secretary *pro tem.* Minutes of preceding meeting were read and approved.

E. R. Van Nardroff was elected resident member; and H. P. Cushing, of Adelbert College, Cleveland, Ohio, and C. Lloyd Morgan, of University College, Bristol, England, were elected corresponding members.

Prof. N. L. Britton presented the report of the Committee on the Audubon monument, and asked that the Committee be discharged. He reported the satisfac ory completion of the monument and the placing of the new die, which was guaranteed for at least two years. He announced that after all the expenses of the monument had been paid a balance of $1,797.25 remained in hand, which the Committee therewith turned over to the Treasurer of the Academy, together with the following resolution:

Resolved, That after all bills incurred by the Committee shall have been paid, the Secretary and Treasurer shall pay over the balance to the Treasurer of the Academy, under the title, "Audubon Publication Fund," the interest of which shall be annually devoted to the publication of a memoir on some zoölogical or botanical topic, if a paper suitable for such memoir shall be presented. If no such paper shall be presented during any one year, the interest shall be allowed to accumulate until one is presented. Memoirs published by this fund shall be so designated.

A committee was appointed to audit the accounts of the report.

There being no further business before the Academy, the Section in Astronomy and Physics then organized, with Prof. Woodward in the chair.

The first paper was by Prof. Harold Jacoby, on "The Determination of Division Errors in Straight Scales." Prof. Jacoby simply read the introduction to the paper and outlined the method. Thereupon, with the permission of the Chairman, he read a historical description of the observatory at the Cape of Good Hope.

The second paper was by C. A. Post, on "Photographs of the Lunar Eclipse of September 2, 1895." The photographs exhibited were very beautiful and brought out some interesting points with reference to the time of exposure.

The third paper of the evening was by Prof. J. K. Rees, on "Drawings made by Percival Lowell of the Markings on the Planet Mars." These drawings corroborate to a very remarkable degree the observations of Schiaparelli. The drawings provoked an animated discussion in which Profs. Mayer, Rees, Post, Jacoby and Hallock took part. The prevailing opinion seemed to be that, although Mr. Lowell deserved much credit for great application and labor, we must await further corroboration before accepting his rather extreme theories.

The Academy then adjourned.

WM. HALLOCK, *Secretary.*

DECEMBER 2, 1895.

To the New York Academy of Sciences:

Your committee appointed October 3, 1887, with power to solicit funds for the erection of a monument to John James Audubon and to construct the same, would respectfully refer to the reports submitted by them on November 5, 1893, and February 26, 1894, and would further report as follows, and request that they now be discharged.

We have caused the die of the monument, which was found defective after it had been put in place, to be replaced by a new one. This new stone was inserted in May of the present year, and gives every evidence of satisfaction; it is further guaranteed by the following letter from the stonecutters, herewith submitted:

ROBERT C. FISHER & Co., East Houston St.,
New York, November 13, 1895.

Dr. Egleston, 35 Washington Square, New York City:

DEAR SIR: We guarantee the Audubon monument from splitting or cracking for a period of two years.

Yours truly, R. C. FISHER & Co.

The committee has paid the balance of the bill due Messrs. Fisher & Co., and would submit the following financial statement:

STATEMENT.

Total receipts from subscriptions, as reported on Nov. 5, 1893		$10,525.21
Interest on sums deposited in the New York Life Insurance and Trust Company, as per vouchers		674.91
	Total receipts	$11,200.12
Disbursements by the committee to Nov. 3, 1893, as reported Nov. 5, 1893		$6,645.07
Jan. 25, 1894,	Bill of G. R. W. Notman for photographs (voucher 54)	82.25
Jan. 31, 1894,	Wrapping, addressing and postage, reprints, report of committee	33.00
Feb. 5, 1894,	Bill of the New Era, reprints, report of committee (55)	22.05
April 5, 1894,	Bill of L. S. Foster, extra prints of invitation cards (56)	10.00
Nov. 16, 1895,	Balance due R. C. Fisher & Co., on construction of monument (57)	2,600.00
Nov. 29, 1895,	Postage and clerical assistance to date	10.50
	Total disbursements	$9,402.87
	Total	

SUMMARY.

Total receipts of the committee	$11,200.12
Total disbursements	9,402.87
Balance	$1,797.25

Checks for this balance, payable to the order of the Treasurer of the Academy are herewith presented.

In paying over this sum, the following resolution of the committee, adopted May 1, 1893, and accepted by the Academy as a part of the report of the committee on November 5, 1893, is submitted:

Resolved, That after all bills incurred by the committee shall have been paid, the Secretary and Treasurer shall pay over the balance to the Treasurer of the Academy under the title "The Audubon Publication Fund," the interest on which shall be annnally devoted to the publication of a memoir on some zoological or botanical topic, if a paper suitable for such a memoir shall be presented. If no such paper shall be presented during any one year the interest shall be allowed to accumulate until one is presented. Memoirs published by this fund shall be so designated. For the committee,

N. L. BRITTON,
Secretary and Treasurer.

13. Lenticular, light gray, in portions coarsely crystalline, in other portions highly fossiliferous, although the fossils are chiefly fragmentary, in still other portions with thin, very compact, sandy streaks. 54′

Orthis testudinaria a a a
——— *æquivalvis* a a.
Calymene senaria a a.
Modiolopsis.
Orthoceras.

14. Gray, rather coarsely crystalline, with included compact nodules. 54′ 9″

The latter contain *Calymene senaria* and *Orthroceras*, the former: —

Orthis (*Dalmanella*) *testudinaria* a a a.
Plectambonites sericea a.
Ptilodictya c.
Stictopora.
Prasopora lycoperdon, large celled var.
Orthis (*Platystrophia*) *biforata.*
Calymene senaria.
Nucula levata.
Lingula ricinriformis.
——— sp.
Bryozoan, probably new.
Monticulipora.
Rafinesquina alternata.
*Parastrophia hemiplicata.**

15–19. Series of compact barren layers, respectively 2′ 3″; 8″ and 5′ thick alternating with shaly layers containing only *Plectambonites sericea.* 63′ 9″

20–23. A series of gray lenticular beds often composed exclusively of an agglomeration of *Orthis testudinaria*, changing abruptly to very compact, barren, heavily bedded black limestone, with a few very thin shaly partings. 68′ 9″

Orthis testudinaria a a a.
Calymene senaria.
Rafinesquina deltoidea.
——— ——— *alternata.*
Prasopora lycoperdon.
Monticulipora small.
Crinoid columns.
Plectambonites sericea.

24. A rather impure limestone with scattered fragmentary fossils; black, irregular fracture, compact with scattered calcite crystals and in portions shaly. 72′ 9″

Prasopora lycoperdon small celled. a.
——— large celled form a.
Asaphus platycephalus (large) c.
Clymene senaria c.
Orthis testudinaria c.
———*subæquata.*
Bellerophon bilobatus.
Diplograptus amplexicaule.
Nucula levata.
Tellinomya dubia.
Stenopora fibrosum.
Ptylodictya.
Strophomena incurvata.
Rafinesquina alternata.
——— ——— *nasuta.*
Lingula Curta.
Beyrichia.
Crinoid fragments.
Cyrtoceras.
Orthoceras vertebrata.

*The occurrence of a single specimen of *Parastrophia hemiplicata* in this layer possessed considerable interest. The species is characteristic of the Black River; occurring in that formation at Watertown, N. Y., associated with *Cypricardites latus* Hall. On Lake Champlain we found it to characterize, in great abundance, a well-marked zone, which contained little else. That zone marks the lowest portion of the Trenton for 78 miles along the lake shore. *See Trans. N.Y. Acad. Sci.*, XXV., 20 and 23 (1895).

25–30. Compact heavy, nearly barren layers, having conchoidal fracture, with intervening shale, the latter containing fragments of:— 102′ 9″

Prasopora. *Lingula curta.*
Crinoid columns. *Orthis testudinaria.*
Asaphus platycephalus. *Orthoceras.*

31. Impure black, breaking irregularly, with calcite seams and a few comminuted fragments of fossils in the purest portion. 114′ 9″

Crinoid fragments a. *Calymene senaria.*
Orthis testudinaria. *Rafinesquina alternata.*

32–33. At the falls near the upper bridge, impure black limestone; the only fossils being scattered *Orthis* and *Asaphus* fragments. 137′ 9″

Conclusions.

Reference to the faunal lists, facilitated by the appended tabulation, suggests several features.

First: The almost universal prevalence of *Orthis testudinaria Rafinesquina alternata*, *Plectambonites sericea*, *Orthoceratites*, *Asaphus platycephalus* and *Calymene senaria* throughout the formation.

Second: The much greater number of forms found in the Black River zones, and in general also in the lower zones than in those above.

Third: The prevalence of *Crinoids*, *Prasopora*, *Rhynchotrema inæquivalvis* and *Trinucleus concentricus*, principally in the lower layers.

Fourth: The appearance of *Parastrophia hemiplicata* so high up in the series in B 14.

Fifth: The first appearance of *Acidaspis Trentonensis*, associated with the most perfect fallen remains of crinoids found, in the uppermost portion, in the shaly partings of the comminuted gray limestone, suggests that the crinoids and the trilobites were killed by the same inflow of muddy water into the purer seas.

Sixth: The absence of various typical Trenton species of frequent occurrence in other localities and not found among the material collected, indicating that they are at least not abundant, if they indeed occur in the region. Some of these species are *Climacograptus*, *Solenopora compacta* Bill, *Orthis occidentalis* Hall, *O. tricenaria* Dalman, *O. subquadrata* Hall, *Leptæna rhomboidalis* Wilck, *Rhynchotrema capax* Con., *Cyclospira bisulcata* Emmons.

	A			B																C						D																		E	
	7 8	9	10	1	2	3 4	6	7 9	10 11	12 13	14	15 19	20 23	24	25 30	31	32 33	1	2	3	4	5	6	1	3	4	6	8	9	10	11	12 13	14 18	19	20	21	22	23	1 2	3
BRACHIOPODA (continued).																																												
Lingula (*Glossina*) *riciniformis* Hall	...	...	...	...	...	...	×	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	r	...	...	...	...	...	...	...	×	...	×
Orthis (*Plectorthis*) *æquivalvis* Hall	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	aa	...	a	...	...	×	...	...	...	×	...	...	×	...	...	...	×	...	×
——— (*Platystrophia*) *biforata* (Schl.) Bill.	...	...	...	...	×	×	×	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	a	...	...	...	...	...	×	...	×	...	...	...	×	×	×	...
——— (*Dinorthis*) *pectinella* (Emmons) Hall	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
——— *subæquata* Conrad	?	...	...	...	...	...	...	...	×	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	×	×	...
——— (*Dalmanella*) *testudinaria* Dalman	...	×	×	×	...	×	...	×	×	×	×	...	aa	c	×	×	×	aa	aa	a	aa	c	aa	×	×	×	×	×	aa	a	...	×	×	...	×	a	...	c	a
Parastrophia hemiplicata Hall	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Plectambonites sericea (Sowerby) Hall	×	×	...	×	×	...	×	...	...	...	×	×	×	...	...	...	...	×	...	...	r	×	...	...	...	×	...	...	c	a	...	×	...	...	...	...	×	×	...
* *Rafinesquina alternata* (Conrad)	a	...	×	...	×	×	×	...	×	...	×	...	×	×	...	×	...	×	a	...	...	...	...	c	×	a	...	×	×	×	...	×	...	×	...	...	×	...	c
* ——— *deltoidea* (Conrad). Note *a*.	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	c	...	...	...	...	...	a	...	...	...	...	...	aa	aa	c	×	×
——— *nasuta* Conrad	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...
* *Rhynchotrema inæquivalvis* Castelnau	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Schizocrania filosa Hall	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Strophomena incurvata (Shepherd) W. & S.	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...
——— *planumbona* Hall	...	...	...	×	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	c	×
Trematis millepunctata Hall.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...
——— *terminalis* (Emmons) Hall	...	...	...	...	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	c	...	c	×	...	...	...	...	c	...	c	...	...	...	...	...	...	c	...
——— n. sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Zygospira recurvirostra Hall	c	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	aa	c	...	...	...	...	...	×	aa	...	×	...	...	...	×	...	...	...	...
PTEROPODA.																																												
Conularia sp?	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?
——— small sp.	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* ——— *Trentonensis* Hall	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...
Hyolithes	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...

NOTE *a*. Possible types of Conrad's species have been found by the writer in Col. Phila. Acad. Nat. Sci. labeled "Trenton Limestone N. Y."

	A			B																	C						D																				E	
	7/8	9	10	1	2	3/4	6	7/9	10/11	12/13	14	15/19	20/23	24	25/30	31	32/33	1	2	3	4	5	6	1	3	4	6	8	9	10	11	12/13	14/18	19	20	21	22	23	1/2	3
GASTEROPODA.																																														
Bellerophon bilobatus Sowerby		×			×									×				×						×	×	×				×		×													
——— sp.	×																															×													
Bucania punctifrons Emmons																											×			e														
Cyrtolites Trentonensis						×	×																																						
Holopea symmetrica Hall				×	×	e																																	r	
——— small species	×																																												
Murchisonia gracilis Hall																										×																			
——— *Milleri* Hall				×																																								
——— sp.	×			×		×																																						
Raphistoma Americana Bill.	c																																											
CEPHALOPODA.																																													
Cyrtoceras														×																															
——— *tenuistriatum* Hall	×																																											
**Endoceras proteiforme* Hall, Note *b*																		×												×															
Gomphoceras																					×																								
Gyroceras							×																			×																			
Orthoceras sp.	×				×					×	×				×			c		a		aa	×	×						×		×												×	×
——— *vertebrata* Hall, 1847														×																															
LAMELLIBRANCHIATA.																																													
**Ambonychia bellistriata* Hall, Note *c*																						?										×													
Cypricardites obtusus Hall	c																																												
*——— *ventricosus* Hall	×																																												
Modiolopsis sp.	×									×																																			
——— *faba* Emmons																																													×
* *Nucula levata* Hall	×										×			×											×	×				×		×												×

NOTE *b*. Original specimens illustrated in Pal. N. Y., I. Pl., LVII. : 1 *a–b* from Trenton Falls, are now in Amer. Mus. Nat. Hist.
NOTE *c*. Pl. N. Y. I: Pl. XXVI. : figs. 4*a–c*, originally figured from types in Moore collection at Trenton Falls. Type of 4*a* now in Amer. Mus. Nat. Hist.

Laramie area known for many years as the Placer coal field. Its basin lies south from the Spanish ranges, the last continuous portion of the Rocky Mountains. The Placer Mountains, consisting largely of eruptive rocks, are about 25 or 30 miles south from Sante Fé, and the patch of Laramie bordering upon them is probably only a detached portion of the area extending southward for a long distance. Other "lost mountains" apparently similar in character to the Placer are seen on the borders of that area further south.

The Placer Mountains were so named because the auriferous gravels on their northern side have been worked in a small way by the Mexicans. The water supply is so insignificant that despite the extraordinary richness of the gravels the amount of gold obtained has been little more than sufficient during many years for the Sante Fé jewelers. Latterly, the Laramie coals have been mined very extensively and new names have been applied to the more prominent localities, so that the Placers are now the Ortiz Mountains, and the Placer coals are in the Cerrillos coal field, the latter appellation being taken from petty hills beyond the Galisteo, containing the celebrated turquoise mine, which was worked for centuries by the Pueblo Indians.

The Galisteo area possesses much interest because of the singular diversity of opinion existing among those who have studied the region. Marcou, Newberry, Le Conte, Hayden, Cope and Stevenson published notices bearing especially upon the relations of beds underlying the Laramie. Newberry and Stevenson described the Laramie beds, though only after reconnaissance fashion; both of these writers recognized the transition from bituminous to anthracite coal in a single bed and found the cause in a great dike following the face of the Placer or Ortiz Mountains.

During August of this year the writer had an opportunity to spend a few days in studying a small portion of the Laramie area—that controlled by the Cerrillos Coal Company. This, lying southward from Waldo and Cerrillos (stations on the Atchison, Topeka and Santa Fé Railroad), is barely a mile and a half wide from east to west and somewhat more than four miles long from north to south. Its eastern boundary is Ortiz or William's Spring cañon. About half a mile west is Coal cañon, which reaches further south and is somewhat deeper than the other. The space between the two cañons, in the area especially under consideration, is irregular, being cut by shallow, longitudinal gorges opening at the north into a rapidly deepening channel-way, which begins almost on the brow of Coal cañon and leads to Ortiz. Further northward, a mesa continues

for a little distance but thence the surface becomes irregular and broken. Southwardly, the surface rises to the Ortiz mountains.

Waldo station, where are the coke works of the Cerrillos Coal Company, is at the mouth of Coal cañon; two miles above it, in the cañon, is the village of Madrid, where one finds the Company's offices.

This area shows apparently all the workable coal beds of the Laramie, and probably contains the greater part, if not practically all of the anthracite. It exhibits the gradations from bituminous to anthracite as well as some phenomena in structure, familiar enough elsewhere, but previously unrecognized here. The student now finds better opportunities for investigation than did the geologists already named, as the mining operations have become extensive, and definite opinions can be reached concerning matters respecting which, under other conditions, only conjectures could be offered.

Several mines have been opened in Coal cañon, the most important being in the immediate vicinity of Madrid; the Lucas, at the southerly end; the Cunningham, at the village, and the White Ash, immediately north from it. These are all on the upper or White Ash bed; two mines on the lower or Cook-White beds are within the village limits but are not worked.*

Geological Structure of the Area.

No anticline occurs and the dip is almost east, N. 85° E., but on Coal cañon, at about a third of a mile below the White Ash mine, the beds show very rapid northward dip for half a mile. Ordinarily the rate does not exceed 15° or 16°, but occasionally for a short distance it is much greater.

No rocks older than the Laramie occur anywhere within the area under consideration except near Galisteo River, where beds of the Fort Pierre stage are reached. But great masses of trachyte, both as dykes and as intrusive sheets, form a characteristic feature of the anthracite area and extend to half a mile or more toward the west.

The Eruptive Rocks.—The most southerly point visited is on Coal cañon at probably four miles above its mouth, where one of the thinner coal beds was coked six or seven years ago. There, as clearly enough for a mile further up the canon, the easterly wall is capped by trachyte, 50 to 100 feet thick on the edge of

*The writer is under many obligations to Mr. James Duggan, Superintendent, and Mr. Porterfield, Engineer of the Coal Company, for information which otherwise he could not have obtained. Mr. Charles J. Devlin, General Manager of Coal Properties of the Atchison, Topeka and Santa Fé Railroad Company, courteously furnished copies of the analyses of the coals.

Silica	26.93
Alumina	32.41
Oxide of iron	3.96
Calcium oxide	24.68
Magnesium oxide	10.32
Calcium sulphate	0.21
Alkalies and loss	1.49
Total	100.00

The calcium oxide is derived from calcium carbonate, which appears as stains and occasionally as crystalline plates along the cleavage. The color of the ash is light yellowish gray; phosphorus is only 0.006; and the specific gravity of the coal is 1.410.

The composition of an average sample of the anthracite embracing nut, stove and egg sizes, taken from the bins at Topeka, is (W. D. Church).

Water	0.16
Volatile matter	1.04
Fixed Carbon	93.02
Ash	5.78
Total	100.00
Sulphur	0.117
The ash consists of	
Silica	32.14
Alumina	36.58
Oxide of Iron	12.85
Calcium oxide	8.19
Magnesium oxide	5.11
Calcium sulphate	0.18
Sodium oxide	1.38
Potassium oxide	3.59
Total	100.00
Phosphorus	0.0033

The color of the ash is given as reddish ochre. The specific gravity varies from 1.537 to 1.540.

These analyses show some curious variations in composition of the ash, there being a very notable increase in the proportions of silica, alumina, oxide of iron as well as of alkalies, while there is a very striking decrease in calcium and magnesium compounds. The volatile matter has been removed, yet the ash remains practically the same. These variations are not easily

explained, unless we regard the coal as originally different in composition at the White Ash and Lucas localities, since the anthracite owes its origin not to longer continuance of the process of conversion from vegetable to coal, but to the prompt action of heat causing metamorphism.

The distance between good bituminous coal and good anthracite is little more than 2,000 feet along the strike; but it must be remembered that the anthracitic character is not lost abruptly in the northerly levels of the Lucas mine; the change takes place gradually, so that even where the mining ceased at 500 feet north from the slope much of the coal is very good. Mining was stopped because the coal is so much broken as to be wasted in the breaker. It should be remembered also that the space between the White Ash and Lucas contains some anthracite of the best quality, as was proved in the sixth level, south of the former mine. At the same time there is every reason to believe that a very great portion of the space between the two mines is occupied by the "tender" coal, showing gradual transition from anthracite to bituminous.

The Cook-White bed, about 150 feet below the *White Ash*, shows a similar change in character, though analyses have not been made of the different grades. Fragments on the dumps of old openings south from Madrid shows that the coal is anthracite. At the lower end of Madrid, about midway between the Lucas and White Ash mines and almost directly under the entrance to the Cunningham mine, the coal of the lower bed is tender, but less so than that from the upper bed, even in the Cunningham. An analysis of coal from this mine by W. D. Church gives its composition as

Water	1.10
Volatile Matter	30.20
Fixed Carbon	60.94
Ash	7.76
Total	100.00

which shows that it contains much less volatile than the White Ash at a little way farther north. The results of this analysis do not agree with those of a test of two carloads. The coal was supposed from its appearance to be rich in gas, but the trial is reported to have shown a yield of only 2,000 cubic feet per ton. As *White Ash* coal yields about 10,000 cubic feet of gas per ton, it would appear that the *Cook-White* coal from this pit should average not more than eight per cent. of volatile.

No analyses of this coal have been made from any locality

84. BACILLUS ZETA.

The cultures are dead.

102. BACILLUS M. FUSCUS CONSISTENS.

Nitrate was not reduced and the growth was not distinctly wrinkly. Otherwise the same.

110. BACILLUS FUSCUS LIQUEFACIENS.

Unchanged, except that the nitrate was not reduced.

112. BACILLUS KAPPA.

Rosalic acid decolorized as before. Milk peculiarly affected. It is not coagulated at first, but in 23 days the whole mass resembles a starch paste, on boiling becoming jelly-like with thick flocculi. Otherwise the same.

114. BACILLUS PLYMOUTHENSIS.

Exactly as in *B. rosaceus metalloides*. The growth is no longer viscous. Lactose litmus agar is not reddened by this species, which would seem to show that the reddening of the lactose-litmus gelatin was due to some product of the liquefied gelatin.

116. BACILLUS KRALII.

Apparently overgrown by a contamination.

117. BACILLUS LARVACIDA.

Unchanged.

120. BACILLUS PYOGENES FŒTIDUS LIQUEFACIENS (Lanz).*

Nitrate completely reduced in 28 days. Rosalic acid is deepened in color. Otherwise as before.

121. BACILLUS PRUDDENI.

Unchanged.

123. BACILLUS BOOKERI.

The lactose litmus agar, while reddened at first, ultimately became blue. The nitrate was strongly reduced as before, and the other characters were the same.

126. BACILLUS SORDIDUS.

Unchanged.

I draw the following conclusions from the results of these replantings.

(1) Species under long cultivation, such as I have received from collections, tend to be constant in their characters.

* Centralblatt f. Bacteriol., XIV., 277.

(2) Some species lose in vigor on repeated cultivation and become incapable of exhibiting certain of their characters, or finally die.

(3) Some species gain in vigor on repeated cultivation, exhibiting certain characters more strongly or even acquiring new ones.

The changes observed for the several species are arranged below in tabular form.

Cultures which died.	Cultures becoming less vigorous, their characters becoming less positive.	Cultures constant.	Cultures becoming more vigorous, with more positive or new characters.
6 70 84	12. The color becomes paler.	8 56 102 121	1. Gelatin is now liquefied.
21 71	13. The color becomes white.	33 57 110 126	25. The cells are more firmly united.
36 78	25. The growth is less abundant.	54 65 114	39. Milk more quickly coagulated.
37 83	44. Nitrate no longer reduced.	55 81 117	40. The gelatin is now liquefied, etc.
	68. The cells are shorter.		59. Nitrate more strongly reduced.
	70. Gelatin no longer liquefied.		62. Rosalic acid more quickly decolored.
			112. Milk more distinctly coagulated.
			120. Nitrate is now reduced.
			123. Lactose litmus agar finally made blue, instead of being simply reddened.

Stated Meeting.

April 20th, 1896.

The Academy met with President Stevenson in the chair. Eighteen persons were present.

The minutes of the last meeting were read and approved.

The Secretary presented the nomination of Mr. E. E. Olcott for resident membership, and it was referred in due course to the Council.

The Section of Geology and Mineralogy then organized and listened to the first paper of the evening, by Mr. John D. Irving, on "The Stratigraphy of the Browns Park Beds, Utah." The paper will appear subsequently in the Transactions.

(*C*). SUPPORTING ELEMENTS OF THE DORSAL AND OF THE PELVIC FIN.

The position of the basal support of the dorsal fin may be outlined in the fossil, Pl. VII., DF, although they are imperfectly preserved. In number they correspond closely to those of Coccosteus, but in other regards they appear to have been widely different; they are thus smaller and slenderer, and the elements of their proximal row, although very imperfectly shown, seem to have differed considerably from the neighboring distal elements. It is also noteworthy that the outer tips of the distal elements appear to have been the more densely calcified, so that indeed these tips could remain after the remaining portion of the element had disintegrated. Several of these separated distal ends may be noted in the fossil. The evidence now presented is sufficient to demonstrate that the dorsal fin of Dinichthys was relatively in the same region as in Coccosteus, but that it was smaller and more delicate, the latter character directly opposed to what might have been inferred on *a priori* grounds.

The pelvic girdle and the basal supports of the ventral fin are shown in the fossil, at VG and VF, Pl. VII. Their preservation is, however, so imperfect that nothing definite can be determined about them; indeed were it not that this portion of the fossil corresponds so closely in position and outline to the structures of the ventral fin and hip girdle in Coccosteus, one could hardly be justified in atttempting an identification. The writer is inclined to believe that the apparently separate elements at VF. are in reality not the basalia of the ventral fins, but artificially separated portions of the distal part of the pelvic girdle.

Fin structures in Dinichthys (terrelli) have already been described by Prof. Newberry, and figured by him in his Palæozoic Fishes (Monograph XVI, U. S. Geological Survey, Pl. VII.). His specimens, however, had been sent him without their matrix, and he could not therefore determine their exact position. They had been received from Ohio from Mr. J. Terrell, who had several times found them associated with the bones and plates of D. terrelli. These "ossified fin rays," as far as Dr. Newberry could judge from a single detached group of them, and from several fragmentary elements, were then believed to represent in part the base of the dorsal fin. The structures of the present specimens are certainly not adverse to this view of Dr. Newberry. But a reëxamination of the types by the present writer leads to the belief that they may well have been exernal fin structures.

They certainly do not correspond to the basalia of the dorsal fin shown in the present material, although they may have represented the external rays. It is possible that they may prove to have been caudal structures.

The additions to a knowledge of the structures of Dinichthys as given in the present paper, may be summarized as follows:

I. Presence of notochordal axial skeleton, of dorsal fin and of pelvic girdle, similar to those in Coccosteus.

II. Presence of an hitherto undescribed pair of dermal plates.

III. Evidence that a pair (and probably, therefore, all) of the plates of the ventral armoring were surface plates.

A contrast of the ventral armoring of Dinichthys gouldi with the corresponding structures in D. terrelli and in Coccosteus (cf. Pl. VIII., Figs. 1, 2 and 3), leads the present writer to believe that the conditions in Coccosteus are most nearly those of the common ancestor of these three forms. And that in D. gouldi are present more generalized conditions than in the larger species. Thus in Coccosteus the plastron is composed of separate dermal plates, more or less rhomboidal in outline, and differing little from each other in size. In Dinichthys, on the other hand, these plates differ more widely from each other in size and outline, the median plates—median ventral and anterior median ventral—no longer broadly lozenge-shaped and separate, are now reduced to a single narrow lanceolate element. In D. gouldi the plates of the plastron overlap as in Coccosteus; in D. terrelli they become more widely unlike each other and are fixed together with definite sutures.

May 12, 1896.

THE HISTORY OF THE ACHROMATIC STRUCTURES IN THE MATURATION AND FERTILIZATION OF THALASSEMA.

By Bradney B. Griffin, B. Sc.

University Fellow in Biology, Columbia University.

The following observations on the eggs of the chætiferous gephyrean, *Thalassema*, were made on a series of stages collected at Beaufort, N. C., by Professor E. B. Wilson, in the summer of 1895, with a view to the investigation of the achromatic structures, and especially the centrosome in maturation and fertilization. In intrusting this material to me Professor Wilson suggested that I should first follow out in detail the history of the centrosome with special regard to its behavior

"Salmon on entering rivers, as a general rule, deteriorate in quality, similarly to what has been shown takes place in sea fishes prevented migrating to the ocean, unless under peculiarly favorable conditions; therefore it becomes a question of what is the effect on salmon debarred from going to the sea.

"During the summer months the salmon roams along our coasts in search of food, and may be found close in shore many miles from where any fresh water enters the sea, loitering in estuaries and also at the mouths of rivers up which it purposes ascending.

"The fish culturist is aware that their eggs will not hatch if deposited in salt water.

"Salmon are anadromous, entering our rivers chiefly for the purpose of perpetuating their race. During their youth they live and feed in fresh water; as they grow older they descend as smolts to the sea, from whence after a time they return as grilse and salmon to the rivers; thus the waters they select for their residence differ from each other in specific gravity, taste, temperature and products.

"Most of the male salmon pars kept at Howietoun had milt in November, 1883, when 2 years and 8 months old. At the age of 3 years and 8 months all of these fish seemed ready to breed, and young were bred from their spawn. Consequently, descending to the sea prior to depositing ova is not a physiological necessity for young salmon."

Upon the breeding habits of the Atlantic salmon Dr. Günther makes the following statement in his *Introduction to the study of Fishes:*

"The salmon offers a most remarkable instance of irregularity as regards the age at which the individuals arrive at maturity. Shaw has demonstrated in the most conclusive manner that those small salmonids, which are generally called parr, are the offspring of the salmon, and that many males, from 7 to 8 inches long, have their sexual organs fully developed, and that their milt has all the impregnating properties of the seminal fluid of a much older and larger fish. No parr has ever been found with mature ova."

Speaking of the same species, Mr. Frank Buckland stated before a Parliamentary Committee in 1877 that a salmon does not breed every year, but once every three years. Mr. Chas. G. Atkins has published observations on the Atlantic salmon in Penobscot River, showing it to be a biennial spawner.

The marine life of the Alaskan salmon is practically unknown, and even the age at which they become sexually mature and return to the rivers to spawn is uncertain. Some ichthyologists

have held to the theory that the salmon mature in three or four years from the time they first leave the rivers, assuming that they go to sea when one year old. This theory is apparently in conflict with the fact that individuals of the same species differing greatly in size enter the rivers simultaneously.

As a guide to the age at which the quinnat salmon becomes sexually mature we have the important experiments of Dr. Jousset de Bellesme in the Trocadéro Aquarium, Paris, and in ponds elsewhere in France. He states that many individuals are mature when three years old, and that they reproduce as well in fresh water without going to sea as they do under the usual conditions in their native waters. At the age mentioned they weigh from thirteen to fifteen pounds.

From recent observations at the Karluk River, Kadiak Island, Alaska, it appears that young red salmon frequently return from sea with the adults, and sometimes ascend the river at least a short distance. Mr. Barling, who manages a fishery at Karluk, called my attention to the return of young salmon with the adults in the following letter concerning the specimens exhibited:

SAN FRANCISCO, CAL., Jan. 9th, 1896.

DR. TARLETON H. BEAN, N. Y. AQUARIUM, CASTLE GARDEN, NEW YORK, N. Y.

Dear Doctor: In the matter of the young salmon sent to you by Mr. Brommage; they were taken out of our nets in the early spring of last season (1895). For many seasons past I have noticed the small fry in surprising numbers standing inshore with the adults, and while I was satified that they were small salmon, I could not so positively state ere this, on account of not being able to catch them before they escaped through the larger meshes. I was enabled to furnish you the few which I sent by backing up the nets with the small-mesh seine; at the time we caught over 1,000 small salmon and only 900 adults.

Some of my friends on the (Karluk) river always maintained that these small fish were trout, and even now some are hardly satisfied. I will state, however, that these small fry salmon are not to be seen in numerous quantities after August 10th.

I have always maintained ever since I have been in Karluk that the fish we catch are not all Karluk bred fish, being merely attracted inshore by the fresh waters from the Karluk river. This year (1895) was not as much so as in many years past, but that was caused by the extreme lengths of the nets driving the salmon outside the range of the inner buoys.

Yours very truly,

(Signed) H. J. BARLING.

LEPIDITTA AURICULATA (Plate XV., figs. 3*a* and 3*b*).

Lepiditta auriculata, Trans. Roy. Soc. Can., vol. xi., pt. iv., p. 99, figs. 2 *a* and *b*.

Only a mould of the left valve is known. This is purse-shaped and has a short ear at each end of the hinge line. There is no marginal rim. Two grooves in the mould at the hinge line show that the hinge had two oblique plates towards the posterior end.

The surface of the mould is highest a short distance below the hinge, whence it descends gradually to the posterior margin, where the valve is nearly flat. This mould also shows faint, parallel ridges, concentric to what is supposed to be the anterior end. Faint lines mark off three quadrate spaces, near the hinge, parallel to the long plate, and corresponding in position to the upper seal-like marks of *L. sigillata* of the Protolenus Zone (Div. 1 *b. 3*).

Size.—Length, 4 mm.; width, 3½ mm.; height of one valve, about ½ mm.

Horizon and Locality.—In the fine olive gray shale of Div. 1 *c* at Hanford Brook, S. Martin's.

This species is something like that which Mr. C. D. Walcott refers to *Nothozoe Vermontiana*, but has a longer hinge line and is more triangular in form; it is also much flatter than that species. Its long hinge line and hinge plates show it to be of the genus Lepiditta.

OSTRACODA.

After the abundance of individuals and the variety of form in the Ostracoda of the Protolenus Fauna, the few found in the Paradoxides bed is somewhat of a surprise. Perhaps the Agnosti so common in the fine shales of bands *c* and *d* usurped the place of the Ostracoda.

PRIMITIA, Jones.

This genus is represented by more than one species in the rocks of the St. John group, and the author proposes to describe here a very tumid form, of which a few individuals have been found.

PRIMITIA ACADICA (Plate XV., figs. 5*a–c*).

Primitia Acadica, Trans. Roy. Soc. Can., vol. iii., pt. iv., p. pl. vi., figs. 22, 22 *a* and *b*.

Outline of the valves elliptical-oblong, with but very slight

projection at the extremities of the hinge line. The valves slope down in all directions to the margin, and the form is so symmetrical that it is difficult to ascertain which is the upper and which the lower side of the valve; but the side on which an obscure marginal fold is found, is supposed to be the lower side. It is also difficult to say which is the anterior and which the posterior end of the valve; one end has a low tubercle and a shallow pit, while the other end is plain; this distinction may be used for the purpose of locating the characters of the inner surface of the test, as seen on the mould of the valve.

The center of the valve is marked by a distinct circular depression, apparently a perforation of the test: from this point a faint medium furrow extends toward the tuberculated end, where it fades out in the shallow pit existing at that end of the valve; this pit is larger than the circular depression at the center of the valve, but differs from it in having no defined margin; beside this larger pit, but nearer to the margin of the valve, is the tubercle above referred to; it is low, somewhat pinched up at the sides, and elongated in the direction of the larger axis of the valve. The slope of the sides of the valve near the margin is nearly vertical, and the marginal fold is very feeble and obscure.

The surface of the valve is granulated, but the granulations are more distinct on the inner than the outer surface; the inner surface is more brilliant than the outer.

This Primitia resembles in form and size the Silurian *P. transiens*, Bar.; its apparently perforated disc recalls another Bohemian species, *P. perforata*, Bar.; in this species the perforation and tubercle are situated near the hinge line, but in ours near the axis.

Length, $3\frac{1}{2}$ mm.; width, 2 mm.

Horizon and Locality.—In the conglomerate-limestone band, Div. 1.c^1, at Porter's Brook, St. Martin's.

In his article on the Olenellus Fauna, of Washington county, New York,* Mr. C. D. Walcott has described a peculiar Entomostracan with a flexible test under the name of *Leperditia (I.) dermatoides* with the remark, "It may be that this species should be referred to a new genus." This fossil resembles one which the author has had in his hands for some time, undescribed. The peculiar wrinkling of the test (under pressure?) separates these fossils from all other Cambrian Ostracoda, and they are here placed in a new genus.

*Fauna of the "Upper Taconic" of Emmons, in Washington county, N. Y., by C. D. Walcott. Am. Jour. Sci., vol. xxxiv., Sept., 1887.

others by features held in common. The abortion of the posterior lobe of the glabella, the absence of the occipital ring, the immutable number of two joints in the thorax, all show the divergence from the common type; and also there is seldom seen on an Agnostus the proof of that development and expansion of the pygidium which can be traced in the moulding of the surface of this shield in most other primordeal trilobites.

Nevertheless there are some indications of a closer resemblance between Agnostus and its allies in the earlier stages of growth than appear in the adult trilobite. Owing to the minuteness of the shield in the young of this genera, it is difficult to make out the outline and contour of the test in the early stages; but it may be said that the pygidium is proportionately broader and both the marginal fold and furrow wider than is found to be the case at a later period; in the early larval stages it thus approximates more in form and contour to other trilobites than at a later period.

By comparing different species of Agnostus, and by a close examination of the surface features of the tests, we arrive at a few indications of the process by which this peculiar self-contained genus has been developed.

To look at some Agnosti (*e. g.* Regii*) one would hardly suspect that there are more than two lobes in the glabella, but on examining others (Fallaces and Longifrontes) it will be seen that there has been an abortion of the true posterior lobe (called "basal lobes"), so that in the Regii it has become a mere ridge. The so-called posterior lobe of the glabella is also itself in some species seen to be indented by two pairs of furrows; hence there are normally five lobes in the glabella.

The abortion of the true posterior lobes of the glabella (the "basal lobes") is the fixation of an early larval condition in Agnostus. This lobe in Agnostus never becomes an integral part of the glabella, but consists of two sl. all triangular lobes (sometimes nearly obsolete) below the level of the glabella and connected behind it by a narrow thread-like ridge. The triangular form of these lobes is not embryonic, it shows a larval development up to a certain point; but its sub-ordination to the glabella and its separation from it, is evidence of subsequent arrest of growth.

The suppression of the occipital ring reduces the cephalic somites in Agnostus to five, which is the complete number in many trilobites which have this ring. In most species of Agnostus the occipital ring is not recognizable, hence the first

*The several sections into which the genus Agnostus has been divided by Tullberg are described at page 204.

joint of the rachis has no protecting cover, except in so far as the attenuated posterior lobe (basal lobes) of the glabella may assume that office, an unusual condition with trilobites. *A. regulus* is the only species known to me that has an occipital ring.

Agnostus is the sole genus among the early Cambrian trilobites, except Microdiscus, in which the pleural groove runs forward in going outward toward the extremity of the pleura, and in association with this we find the point of the pleura in most Agnosti turned forward,* this is especially plain in Longifrontes. In Fallaces the pleural groove on the posterior segment lies along the front of the pleura, but on the anterior segment at the back; hence the pleura in this group is inflated in the middle and tubercle-like; on the anterior segment there are really two grooves, of which the anterior affords an interlocking edge with the marginal fold of the head shield when the body if folded together.

The long pygidium of an Agnostus assures us that this part has undergone very considerable changes from the early larval moults, but the proof is not often apparent; an examination of the tests of two species (*A. Acadicus* var. *declivis* and *A. Nathorsti*) give an inkling of the way in which the changes have ome about—those which resulted in the three-lobed rachis of the early Agnosti.

In *A. Nathorsti* and other Lonigifrontes the attenuated and depressed end of the rachis is the original pygidium, the front of this part is marked by a minute tubercle (to be found only in well preserved tests); in a rare example of the pygidium of *declivis* three pairs of scars behind this tubercle point out the existence of three somites here; two pairs of scars in front of this little tubercle indicate the presence of two more somites, which complete the posterior lobe of the rachis; these two somites swell out to greater width and height than those behind; the anterior of these two somites is also sometimes further marked off by a pair of furrows, one on each side of the rachis corresponding to the oblique furrow on each side of the anterior lobe of the adult rachis; in Regii these furrows are so strongly developed that this somite was counted by Barrande as a part of the middle lobe of the rachis. The middle lobe and the anterior lobe of the rachis form another enlarged pair of somites with a tubercle or spine at the back, and correspond to the two front somites of the posterior lobe.

We thus see that by its pygidium Agnostus shows three stages

*An exception to this almost universal rule is *A. granulatus* Barr., but it is one of the few Agnosti that have genal spines.

NOTE—204 of last line p. 208, should be 210.

TRANSACTIONS N. Y. ACAD. SCI., XV., Sig. 11, August 14, 1896.

The pygidium is more remarkable. One of $\frac{3}{4}$ mm. has an oval form; the anterior margin is straight and without fold, marginal fold around the rest of the shield widening backward. Rachis oblanceolate, trilobed by faintly impressed furrows, front lobe narrow, middle lobe wide but not tuberculate, side lobes with two transverse furrows, the posterior about one-third from the front.

In this individual I conjecture that the anterior of the two furrows on the side lobes, will become the anterior marginal furrow of the pygidium, and the posterior a first furrow on the side lobe; the pygidium would then agree with a similar stage of Microdiscus as regards these lobes, but not as regards the rachis.

This minute pygidium shows a simpler structure than the adult, which, notwithstanding that the rachis is not segmented, is sometimes so preserved as to show the number of somites in the rachis. Thus the adult caudal shield (see pl. xv., fig. 11*d*) is sometimes well enough preserved to show on the cast of the inner surface a row of minute tubercles on each side of the rachis (five in number) and two on the axial line; the lateral tubercles are placed on the line between the somites, and each of the axial tubercles in the middle of a somite; it thus appears that the somites are in pairs, one with and the other without an axial tubercle. The first and second somites correspond to the first and second lobes of a Longifront pygidium, and the remainder of the axis to the third lobe in the pygidium of an individual of that section of Agnostus. Also we observe that while in the first larval stage there are only three somites recognizable in the pygidium, the adult caudal shield has six.

Agnostus declivis may be compared with the later *A. secretus* Walc., of the Prospect Mountain group, which it resembles in general form as well as in having the glabella tumid behind. Neither this variety nor the type of *A. Acadicus* appears to have any very near allies among the species of the Paradoxides beds of Sweden, known to the author.

Size—Length, about 7 mm. Width, 3 mm. Cephalic shield 8 x 3 mm.

Horizon and Locality.—Abundant in the fine, dark shales of Div. 1 d^1 at Porter's Brook, St. Martin's.

Agnostus parvifrons Linnarsson.

Agnostus parvifrons Linrs. Om. Vestergötland Cambr. o. Silur. aflagr., p. 82, tafl. 2, fig. 56, 57.

Agnostus parvifrons Tullb. Om. Agnostus-arterna, p. 34, tafl. ii., figs. 26, 27, 28.

Test smooth. Head-shield enclosed by a marginal fold that is broader in front. Glabella small, round, not lobed. Basal lobes small. Cheeks expanded, connected in front of the glabella; pygidium without spines; marginal fold wider behind; rachis long, almost reaching the border; lobes sometimes obsolete, sometimes apparent; middle joint ornamented with an elevated point; lateral lobes narrowed behind, scarcely contiguous.

Size.—Length and breadth of each shield, $3\frac{1}{2}$–$4\frac{1}{2}$ mm.

Horizon and Locality.—Dark gray shales of Div. 1 d^1 at Porter's Brook, St. Martin's, etc.

Mr. C. D. Walcott has described a species of *Agnostus* of the *parvifrons* type found in the Lower Cambrian rocks of Washington County, N. Y. Being claimed as a Lower Cambrian (*i. e.*, Olenellus Zone) fossil, it is not figured here. The glabella is longer than in *A. parvifrons*. It may be remarked, however, that this type of *Agnostus* is not found elsewhere lower down than the *P. Abenacus* (=*tessini*) sub-zone.

A common variety in Canada is the following:

Var TESSELLA. pl. xvi., figs. *a* to *c*.

Agnostus tessella. Trans. Roy. Soc. Can. vol. iii., pt. iv., p. 71, pl. vii., figs. 7*a* to *c*.

This is a transitional form to the Limbati (Fallaces). It differs from the type in having an anterior lobe to the glabella faintly defined; this has no furrow like the posterior lobe, but is marked out by a faint thread-like line on the surface of the test. The posterior lobe is intermediate in length between the two glabellas of *A. parvifrons* figured by Tullberg, but rectangular in front. The pygidium is similar to fig. 27*b* of Tullberg's plate, but the tubercle is elongated, not round as in that form; the rachis is wider, and its middle lobe proportionately shorter. The marginal fold does not have so great a width behind.

Size.—Length and width of the shields each 3 mm.

Horizon and Locality.—Same as the preceding.

Development of the Young.—A head shield $\frac{1}{2}$ mm. long is narrow, marginal fold and furrow distinct. Glabella long, front furrow distinct, two others faintly marked by depressions crossing the glabella; basal lobes very narrow, scarcely visible.*

A head $1\frac{1}{4}$ mm. has nearly the form of the adult, slight furrows at the anterior corners of the glabella as in *A. fissus* var.

* This is in accordance with the changes of this lobe in the Ptychoparidæ in which during the first larval satges this somite is very narrow and weak.

Although the pygidium of our species and that of *M. sculptus* are alike, the head shields are quite different, and the number of thoracic joints differs.

MICRODISCUS PULCHELLUS, Hartt. Plate xvii., fig. 8 *a* to *f*.

Microdiscus punctatus (Salter) Whiteaves. Am. Jour. Sci., 3 ser., vol. xvi., p. 225.

Microdiscus pulchellus, Hartt, Ms. in List to Sir J. W. Dawson.

Microdiscus punctatus, Walcott, U. S. Geol. Surv., Bull. 10, p. 24, pl. ii., figs. 1 *a* to *c*.

Microdiscus punctatus var. *pulchellus*, Trans. Roy. Soc. Can., vol. iii., pt. iv., p. 74, pl. vii., figs. 12 *a*, *b* and *c*.

Description (by Mr. C. D. Walcott).—"Head semi-elliptical in outline, rather strongly convex, and bordered on the front and sides by a depressed furrow and raised rim, the furrow containing numerous short furrows perpendicular to the margin, as in *M Dawsoni*, but not as strongly marked. The posterior border is strong back of the cheeks, and has the furrow continuing from the sides; a very narrow rim extends back of the glabella; eyes and facial sutures entirely absent.

"Glabella elongate conical, extending backward in a strong spine, as long as the glabella in medium-sized specimens, and nearly as broad at the base. In some examples the spine is shorter and smaller. The glabella rises above the level of the cheeks, and is about three-fifths of the length of the head, bordered by strong dorsal furrows that are connected in front by a straight furrow with the depressed groove within the anterior marginal border, perceptibly marked by two pairs of oblique glabellar furrows in some examples. Cheeks convex, prominent, strongly defined by the dorsal and marginal furrows.

"Thorax unknown." [see below.]

"The pygidium, associated with the head of this species in great numbers, has the same general outline as the head. The narrow, margined rim is well defined all around, widest at the sides; anterior marginal furrow very distinct; median lobe elongate conical, extending back nearly to the marginal groove; nine anchylosed segments are indicated by eight rather strong, transverse furrows; lateral lobes strongly convex, no furrow appearing back of the anterior marginal groove."

Sculpture.—"Surface finely punctate, the punctæ being rather large as compared with the depth.

Size.—Dimensions of a rather broad head. Length, 3.5 mm. (also 4½ mm.). Pygidium, length, 3.75 mm. (also 4½ mm.).

Breadth, 5 mm. There is considerable variation in the proportion of the parts.

"This is an abundant and well-marked species. The pygidium is very similar to that of *M. speciosus*, Ford, of the Olenellus Fauna. In event of the two forms *M. punctatus* and *M. pulchellus* proving distinct, I propose that Mr. Hartt's name, *M. pulchellus*, be given to the American species.

The following particulars may be added to the description of this form given by Mr. Walcott, in Bulletin 10.

The occipital spine is much more slender in the author's examples than in those figured by Mr. Walcott; it is flattened at the sides, and frequently rises from the plane of the head shield at an angle of 45°.

The short, transverse furrows on the marginal fold of the head shield differ from those of *M. Dawsoni* in being closer together and at about equal distances all around the margin; they are not on the outer surface of the fold. but only indent the inner surface of the test, hence they are not visible from above when the test is perfect.

No complete thorax has been found in connection with the shields, but the separated joints show a strong axial ring which has a row of obscure tubercles along the ridge similar to those on the posterior rings of the rachis; the pleuræ are strongly arched, and have a long and deep furrow directed somewhat obliquely backward; they seem not very rigid and terminate in rounded points.

According to Mr. Walcott the median lobe of the pygidium has eight segments, including the articulating ring, but well grown examples show nine well marked rings, and three other smaller, less distinct ones, near the end of the rachis. When one-quarter grown this species has seven distinct rings in the rachis, the number in the mature *M. punctatus*, according to Mr. Salter. From this species *M. pulchellus* differs not only in respect to the number of these rings, but also in having a smaller and more erect occipital spine.

Sculpture.—The test of *M. pulchellus* has been described as punctate, but this remark applies only to the head shield and thorax, for the pygidium is tuberculate on the side lobes. It may be added that the strong rings of the rachis carry each a low spine at the summit; but on the weak posterior rings the crest is ornamented with a row of small tubercles.

Size.—The dimensions given above are of the largest shields, more frequently it is a third smaller.

Development of the Young.—The change of this species as it grew from a Protaspis stage similar to that of other trilobites

FIG. 2. *S. concentrica* var. *radiata*. Mag. $\frac{1}{1}^{0}$. From Div. 1 *c*, St. John, N. B. See p. 202.

FIG. 3. *Stenotheca Hicksiana*. Mag. $\frac{4}{1}$. From Div. 1 *d*[1], St. Martin's, N. B. See p. 205.

FIG. 4. *Stenotheca triangularis*. *a*, a cast of, showing the outline of the cone and the thickened apex. *b*, a cast without the outline. Both mag. $\frac{4}{1}$. From Div. 1 *c*[2], St. John, N. B. See p. 203.

FIG. 5. *Strobilepis spinigera*, J. M. Clarke. Terminal plate (and penultimate plate in outline). Figured for comparison from Dr. Clarke's restoration. Mag. $\frac{3}{1}$. The terminal plate is partly covered by the penultimate. Devonian species. See p. 203.

FIG. 6. *Stenotheca nasuta*. *a*, small example, mag. $\frac{6}{1}$. *b*, original type mag. $\frac{4}{1}$. Both from Div. 1 *c*, St. John, N. B. See p. 204.

FIG. 7. *Plumulites Manuelensis*, n. sp, mag. $\frac{4}{1}$. From Div. 1 *d*[2], Manuel Brook, Newfoundland. See p. 200. (Misprinted Plate XV. on p. 200.)

FIG. 8. Cirripedian and other plates. Type A, *a* and *b*, two forms of oval plates. Type B, *a*, ribbed plate; *b*, smooth plate. Type C, *a*, plate with deep furrow; *b*, plate with high umbo; *c*, plate with eared flange; *d*, plate similarly flanged but more regular; these are perhaps Cystidian. Type D, symmetrical plate, perhaps one of the axial row of plates. Type E, triangular plate with radiating ridges (possibly cystidian). Type F, triangular plate with arched keel (*Cirropodites Cambrensis*). Type G, triangular plate with facetted edges. All the figures except 8 G, a, mag. $\frac{2}{1}$ 8 G, a, is mag. $\frac{4}{1}$. The narrow figures beside the larger ones are sections. See p. 206.

PLATE XV., OSTRACODA AND AGNOSTUS (part).

FIG. 1. *Lepiditta alata*. *a*, outer surface of left valve. *b*, cast of interior of right valve. Mag. $\frac{3}{1}^{0}$. From Div. 1 *c*[2], St. John, N. B. See p. 194.

FIG. 2. *Lepiditta curta*. Interior of left valve. Mag. $\frac{1}{1}^{0}$. From Div. 1 *d*[1]. St. Martin's, N. B. See p. 195.

FIG. 3. *Lepiditta auriculata*. *a*, left valve showing faint concentric lines and the ligamental (?) groove at the hinge. *b*, same, hinge line in profile. Mag. $\frac{4}{1}$. From shales of Div. 1 *c*, St. Martin's. See p. 196.

FIG. 4. *Aluta flexilis* n. g. et sp. left valve (with lower margin restored) showing ocular (?) tubercle, Mag. $\frac{6}{1}$. From conglomerate limestone band in Div. 1 *c*[1], St. Martin's, N. B. See p. 198.

FIG. 5. *Primitia Acadica*. *a*, left valve. *b*, longitudinal section. *c*, transverse section. Mag. $\frac{6}{1}$. From Div. 1 *c*[1], St. Martin's, N. B. See p. 196.

FIG. 6. *Agnostus fallax* var. *vir*. Complete, somewhat flattened. Mag. $\frac{2}{1}$. From Div. 1 *c*[2], St. John, N. B. See p. 215.

FIG. 7. *A. fallax* var. *concinnus*. *a*, head shield. *b*, a joint of the thorax. *c*, Pygidium. Mag. $\frac{2}{1}$. From Div. 1 *d*[1], St. Martin's, N. B. See p. 216.

FIG. 8. Same variety. *a*, head shield of young larva retaining embyonic (Protaspis-like) features. Mag. $\frac{2}{1}^{0}$. *b*, young pygidium showing somites and posterior tubercle on rachis, effaced in later stages. Mag. $\frac{1}{1}^{0}$. Both from Div. 1*d*[1], St. Martin's, N. B. See p. 216.

FIG. 9. *A. fallax* var. *trilobatus*, n. var. Pygidium. Mag. $\frac{4}{1}$. From Div. 1 *c*[1], St. John, N. B. See p. 216.

FIG. 10. *Agnostus Acadicus*, Hartt. *a*, head shield. *b*, pygidium. Mag. $\frac{3}{1}$. From Div. 1 *c*[1], St. John, N. B. See p. 217.

FIG. 11. *A. Acadicus* var. *declivis*. *a*. head shield. *b*, pygidium. Mag. $\frac{1}{1}$. *c*, larval pygidium showing embryonic features. Mag. $\frac{1}{1}\frac{5}{5}$. *d*, adult pygidium in the rachis of which are six somites. Mag. $\frac{5}{1}$. All from Div. 1 d^1, St. Martin's, N. B. See p. 219.

PLATE XVI., AGNOSTUS.

FIG. 1. *Agnostus regulus*. *a*, head shield. *b*, a joint of the thorax. *c*, Pygidium. Mag. $\frac{1}{1}$. From Div. 1 c^2. See p. 213.

FIG. 2. *Agnostus rex* Barr. var. *transectus* n. var. Pygidium, Mag. $\frac{1}{1}$. From Div. 1 d^1, St. Martin's. See p. 214.

FIG. 3. *Agnostus parvifrons* Linrs. var. *tessella*. *a*, head shield. *b*, thorax. *c*, pygidium, Mag. $\frac{5}{1}$. From Div. 1 d^1, St. Martin's, N. B. See p. 221.

FIG. 4. *Agnostus umbo*. *a*, head shield. *b*, pygidium. Mag., $\frac{4}{1}$. From Div. 1 d^1, St. Martin's N. B. See p. 222.

FIG. 5. *Agnostus obtusilobus*. Mag. $\frac{2}{1}$. From Div. 1 d^1. St. Martin's N. B. See p. 223.

FIG. 6. *Agnostus Davidis*, Hicks. Pygidium. Mag. $\frac{2}{1}$. From Div. 1 d^2, Manuel Brook, Newfoundland. See p. 225.

FIG. 7. *Agnostus gibbus*, Linrs. var. *partitus*. Head shield. Mag. $\frac{1}{1}$. From Div. 1 c^2, St. Martin's, N. B. See p. 227.

FIG. 8. *A. gibbus* var. *acutilobus*. Mag. $\frac{2}{1}$. From Div. 1 d^1, St. Martin's, N. B. See p. 227.

FIG. 9. *Agnostus Nathorsti*, Brögg, var. *confluens*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{1}{1}$. From Div. 1 d^1, St. Martin's, N. B. See p. 230.

FIG. 10. *Agnostus fissus*, Lundgr. var. *trifissus*, n. var. Mag. $\frac{1}{1}$. From Div. 1 d^1, St. Martin's, N. B. See p. 231.

FIG. 11. *Agnostus punctuosus*, Ang. *a*, head shield. *b*, pygidium. Mag. $\frac{2}{1}$. From Div. 1 d^2, Highland Cove, Newfoundland. See p. 232.

PLATE XVII., AGNOSTUS AND MICRODISCUS.

FIG. 1. *Agnostus lævigatus*, Dalm., var. *terranovicus*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{1}{1}$. From Div. 1 d^2, Highland Cove, Newfoundland. See p. 233.

FIG. 2. *A. lævigatus* var. *mammilla*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{1}{1}$. From Div. 1 d^2, Highland Cove, Newfoundland. See p. 235.

FIG. 3. *A. lævigatus* var. *ciceroides*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{1}{1}$. Found with the preceding. See p 234.

FIG. 4. *Microdiscus Schucherti* n. sp. *a*, head shield. *b*, pygidium. Mag. $\frac{1}{1}$. From Olenellus limestone, Troy, N. Y. See p. 238.

FIG. 5. *Microdiscus Dawsoni*, Hartt. *a*, head shield. *b*, same in profile. *c*, pygidium. Mag. $\frac{1}{1}$. *d*, young larval stage, head shield. Mag. $\frac{1}{1}\frac{0}{0}$. *e*, next larval stage, head shield. Mag. $\frac{1}{1}\frac{0}{0}$. All from Div. 1 c^1, St. John, N. B. See p. 240.

FIG. 6. *Microdiscus speciosus*, Ford. head shield. Mag. $\frac{3}{1}$. From Olenellus limestone, Troy, N. Y., figured for comparison. See p. 236.

FIG. 7. *Microdiscus precursor*. Head shield. Mag. $\frac{1}{1}$. From Div. 1 c^2, St. Martin's, N. B. See p. 239.

FIG. 8. *Microdiscus pulchellus* Hartt. *a*, head shield. *b*, same in profile. *c*, pygidium. Mag. $\frac{1}{1}$. *d*, embryonic or Protaspis stage. Mag. $\frac{2}{1}\frac{0}{0}$. *e*, early larval stage. *f*, pygidium of same. Both Mag. $\frac{2}{1}\frac{0}{0}$. All from Div. 1d^1, St. Martin's, N. B. See p. 242.

ON THE EXISTENCE OF PRE-CAMBRIAN AND POST-ORDOVICIAN TRAP DIKES IN THE ADIRONDACKS.

By H. P. Cushing.

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Scarcity north of the Adirondacks	251
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Introduction.

As one commences field work in the eastern Adirondacks, the numerous dikes of the region early thrust themselves on the attention, and as they are studied and mapped certain facts regarding their distribution become obvious and demand explanation. These facts are more prominently brought out in Clinton county, N. Y., where the writer has been at work, than is the case in Essex county and in western Vermont, where the dikes have been so thoroughly studied by Prof. Kemp, though many of them have been noted and published by him. In the writer's opinion they lead so irresistibly to the conclusion that there have been two periods of dike formation in the Adirondacks, quite widely separate in point of time, that it is deemed wise to publish the evidence even though at present it falls short of absolute demonstration.

Present Rock Classification.

Kemp has recently published the following scheme of classification for the rocks of the eastern Adirondacks,* as the best that can be done with our present knowledge of the district. With the exception here discussed, the writer fully agrees with his generalization.

The series is as follows, commencing at the bottom:

I. "A gneiss series, usually laminated, but at times quite massive. The gneisses almost always contain quartz. The

*J. F. Kemp, Rep. N. Y. State Geol., 1893, Vol. I., p. 144.

dark silicate is variable and frequently lacking. The orthoclase is almost invariably microperthitic. The rocks of this series contain the workable iron ores."

II. "A series of crystalline limestones and ophicalcites, black hornblende-pyroxenic schists and thinly laminated garnetiferous gneisses."

III. "A series of rocks of the gabbro family, ranging from pure aggregates of labradorite through varieties with increasing amounts of dark silicates to basic olivine gabbros. The rocks of this series contain the titaniferous iron ores."

IV. "A series of Palæozoic sedimentary rocks, whose oldest member is the Potsdam sandstone and whose latest member thus far identified is the Utica slate."

V. "A subordinate series of igneous rocks that now form dikes, and one notable laccolite, and that are later than the Utica slate. These consist of "trachyte" (bostonite) and of basic dikes, mostly diabase."

Proposed Change in the Classification.

The contention of this paper is that there should be inserted between III. and IV. of the above classification a sub-division, as follows:

A subordinate series of igneous rocks that now form dikes, that followed after the dynamic metamorphism of the first three series and antedated the beginning of deposition of series IV., and that in their typical development consist of diabase.

And furthermore, that from the description of series V. the word diabase be stricken out, and that the last sentence of this description be made to read that these consist of "trachyte" (bostonite), and of basic dikes, mostly camptonites and monchiquites.

The Dikes.

Description.—The various rock species which the dikes furnish have been recently so fully described by Kemp and Marsters* that any extended description of them here seems superfluous. A group of acidic dikes of trachytic habit occurs to which the name bostonite has been applied. By far the greater number of the dikes are quite basic, and are called diabases, camptonites, monchiquites or fourchites, according to variations in mineral content and in structure.

Distribution.—Perhaps the earliest impression to be gained concerning the distribution of the dikes is that they are found more frequently cutting the Pre-Cambrian series than the Pa-

* Bull. U. S. Geol. Surv.

Transactions N. Y. Acad. Sci., Vol. XV., Sig. 17, Sept. 25, 1896.

from interbedding or intrusion, but the latter explanation is strongly indicated both by the exposures themselves and by analogy with other localities. When this locality is compared with those where the minerals are clearly the product of contact metamorphism, decided differences appear. The light-gray amphibole is a new factor; the scapolite is absent, and the pyroxene is of a light-green color and, from its superficial properties, would be classed as diopside. The pyroxene of the other localities is, on the other hand, dark-green or black, and decidedly augitic in aspect. Whether or no such differences as these point to a decidedly different origin cannot, as yet, be positively stated, but on *a priori* grounds it seems very doubtful that they do. Variation in the character of the intrusive rock and of the limestone would certainly seem a sufficient cause; while some localities, as yet undeveloped, show an association and habit intermediate between the extremes described.

To sum up briefly the leading facts presented above: Pyroxene, phlogopite, scapolite, titanite and feldspar, together with apatite, tourmaline, wollastonite, quartz and zircon, often occur together, and in several instances they are clearly a product of contact metamorphism.

Generally the intrusive rock is of intermediate composition, while the rock which it cuts is limestone.

In all of these cases it seems clear that heated solutions and gases have been the immediate agents of mineral formation.

Several of the above-named minerals also occur with light-gray amphibole on the contact between gneiss and limestone, and while the evidence is not conclusive it is probable that they are formed in the same way. In other cases it is possible that minerals on gneiss-limestone contacts may be a product of regional metamorphism.

Finally, a similar association appears when there is no other rock than the limestone shown. For such occurrences it is only possible to infer their origin from their resemblance to more clearly defined examples.

In conclusion, it should, perhaps, be added that if there appears to be, in the foregoing pages, an attempt to exaggerate the importance of contact metamorphism as a source of minerals, it is simply due to the fact already stated, but possibly not sufficiently accentuated, that this paper aims to consider only the single class of mineral occurrences which are certainly, or possibly, of this type.

HAMILTON COLLEGE, CLINTON, N. Y., June, 1896.

Minutes of the Meeting.

May 25th, 1896.

A meeting of the Philological sub-section of the Section of Anthropology, Psychology, and Philology of the New York Academy of Sciences was held in Hamilton Hall, Columbia University, on the evening of May 25th, 1896, at eight o'clock. Fifteen members of the Society were present and President J. J. Stevenson was in the chair.

The President called upon Prof. Franklin H. Giddings, as Chairman of the sub-section to preside at the meeting. The presentation of the communications by the members which had been announced for the session was immediately begun.

Prof. Thomas R. Price, of Columbia University, brought forward the results of certain investigations upon "The Tradition of the Case-Forms in Chaucer's Noun." Carefully collected statistics show that Chaucer in his syntax, uses the case-forms in the following order of frequency: (1) dat. sg., (2) nom. sg., (3) acc. sg., (4) dat. pl., (5) acc. pl., (6) nom. pl., (7) gen. sg., (8) gen. pl. And again with reference to the relative proportion of usage there is a difference between the Teutonic noun and the Romance noun. Statistics were presented to illustrate the ratio.

Prof. Laurence A. McLouth, of New York University, discussed, "Some of the Sources of Bürger's Lenore," basing his investigations mainly on studies of Bürger's letters and of the books that formed the chief part of his reading. No less than eight different sources were shown to be capable of being traced with fair certainty. Among these Shakespeare stood high upon the list.

Prof. Henry A. Todd, of Columbia University, treated "The Etymology of Italian *andare* and related Words." Various etymologies that had been suggested were examined, but the paper favored bringing the word into association with Lat. *indagare* "to investigate."

			Elected.
Peabody, Hon. C. A.		70 West 21st St.	1879
Pell, Alfred		20 East 35th St.	1896
Pellew, C. E.	F	68 East 54th St.	1883
Perry, Prof. Edward D.		Columbia University	1896
Pettigrew, D. L.		Box 1004, Worcester, Mass.	1896
Pfister, J. C.		Columbia University	1895
Phœnix, Lloyd,		Union Club	1895
Pierson, Israel C., Ph. D.	F	21 Cortlandt St.	1892
Piffard, Dr. Henry G.		10 West 35th St.	1896
Pitkin, Lucius		138 Pearl St.	1884
Post, C. A.		21 Washington Sq., N.	1891
Post, George B.		11 West 21st St.	1895
Potter, Hon. O. B.		3 East 57th St.	1889
Price, Prof. Thomas R.		Columbia University	1896
Prime, F. E.	P	26 Broad St.	1864
Prime, Temple	P S	26 Broad St.	1852
Prince, Prof. John D.		19 West 34th St.	1896
Prudden, Prof. T. M., M. D.		Columbia University	1894
Pupin, Prof. M. I.		Columbia University	1890
Quackenboss, J. D.		331 West 28th St.	1890
Rees, Prof. John K.	F	Columbia University	1882
Rice, Prof. Charles		Bellevue Hospital	1876
Ricketts, Prof. P. De P.	F	Columbia University	1871
Ries, Heinrich		305 East 53d St.	1892
Riley, R. Hudson		Bensonhurst, N. Y.	1890
Ripley, John H., M. D.		605 Lexington Ave.	1884
Rusby, Prof. Henry H., M. D.	F	College of Pharmacy	1889
Sabine, Wm. T., Jr.		960 Madison Ave.	1896
Satterlee, Livingston		New Brightom, Staten Is.	1859
Schemerhorn, F. A.		61 University Place	1867
Schemerhorn, Wm. C.		49 West 23d St.	1891
Schoonmaker, Wm. D.		28 Warren St.	1888
Schuyler, Philip		Irvington, N. Y.	1876
Senff, C. H.	P	Whitestone, N. Y.	1895
Serrell, Lemuel W.		140 Nassau St.	1876
Shriver, Walter		333 East 56th St.	1878
Shultz, Carl H.		445 First Ave.	1878
Sieberg, W. H. J.		158 East 124th St.	1877
Silver, Lewis Mann, M. D.		103 West 72d St.	1896
Skeel, Frank D., M. D.		361 Mott Ave.	1890
Sloan, Samuel	P	26 Exchange Place	1876

			Elected.
Smith, Ernest E., M. D.		157 East 74th St.	1894
Starr, Prof. M. Allen		22 West 48th St.	1894
Stetson, F. L.	L	576 Madison Ave.	1895
Stevens, George T., M. D.		33 West 33d St.	1882
Stevens, Prof. W. LeConte	F	Rensaelaer Poly. Inst, Troy, N.Y.	1882
Stevenson, Prof. J. J.	F	468 West End Ave.	1880
Steward, D. Jackson	P	20 Gramercy Park	1858
Stoddard, Prof. F. H.		University Heights	1896
Stokes, James		49 Cedar St.	1896
Stratford, Prof. Wm.		245 West 52d St.	1895
Strong, Charles A.		Hotel San Remo	1896
Stuyvesant, Rutherfurd		246 East 15th St.	1868
Sutro, Mrs. Mathilde		60 West 49th St.	1890
Taggart, Rush, Esq.		319 West 75th St.	1896
Tatlock, John, Jr.	F	Box 194, New York City	1891
Taylor Charles Fayette, M. D.	F	201 West 54th St.	1876
Taylor, Henry L., M. D.		201 West 54th St.	1877
Terry, James		New Haven, Conn.	1883
Thompson, Prof. W. Gilman		University of New York	1895
Todd, A. J.		261 Broadway	1878
Todd, Prof. H. A.		Columbia University	1896
Tows, C. D.		Buckingham Hotel	1878
Trotter, Alfred W.		26 Cortlandt St.	1875
Trowbridge, Charles C.		Columbia University	1894
Tuckerman, Alfred		342 West 57th St.	1892
Valentine, Philip J., Ph. D.		351 Lenox Ave.	1882
Van Buren, Fred. T.		21 West 14th St.	1880
Van Brunt, Cornelius	F	319 East 57th St.	1876
Van Giesen, Ira, M. D.		Columbia University	1894
Van Ingen, Gilbert		Columbia University	1896
Van Nardroff, Prof. E. R.		89 Quincy St., Brooklyn	1895
Van Slyck, George W.		120 Broadway	1878
Vulté, H. T., Ph. D.	F	Columbia University	1890
Wade, H. T.		Columbia University	1895
Wall, John L.	F	338 Sixth Ave.	1879
Waller, Elwyn, Ph. D.	F	440 First Ave.	1871
Ward, Delancy W.		Columbia University	1893
Weston, Henry	P	29 Broadway	1865
Weston, Theodore		14 East 48th St.	1896
Wheeler, Prof. J. R.		Columbia University	1896

PLATE II.

View of Sherman Fall, Kauya Hoora Gorge, Trenton Falls, N. Y. Photographed by Theodore G. White, November, 1895. The lower of the two black seams shown in the fall is D 7, the upper is D 9; while the layer D 11, again shown in Plate IV, figure A, is seen just above the top of the main volume of the fall on the left hand side. The underlying layers are shown nearly down to D 1.

PLATE III.

Fig. A. Undulations in layer (D 15) between lower and upper portion of the Great Fall, Kauya Hoora Gorge, Trenton Falls, N. Y. Undisturbed horizontal layers are seen both above and beneath. Photographed by Theodore G. White, November, 1895.

Fig. B. Overlap structure of bedding of Trenton limestone, on east bank of West Canada Creek, in "Rocky Heart," Trenton Falls, N. Y. The lower portion in the view is covered by water. Photographed by T. G. W., November, 1895.

FIG. A.

FIG. B.

PLATE X.

ILLUSTRATING THE PAPER OF BRADNEY B. GRIFFIN, p. 163.

FIG. 7. Second polar spindle, still tangential in position. Slightly later than Fig. 6.

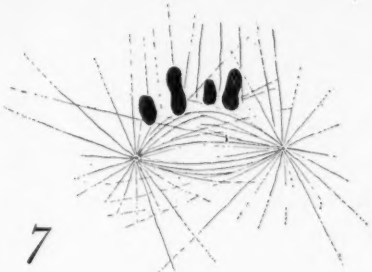
FIG. 8. Second polar spindle. Spermhead with amphiaster (♂).

FIG. 9. Second polar telophase, showing centrosomes divided. Spermhead and amphiaster (♂).

FIG. 10. Shortly before copulation of pronuclei, showing male pronucleus (♂) with powerful asters, and the female vesicles (♀) devoid of asters.

FIG. 11. Copulation of pronunclei.

FIG. 12. Somewhat later stage, segmentation nucleus elongating.



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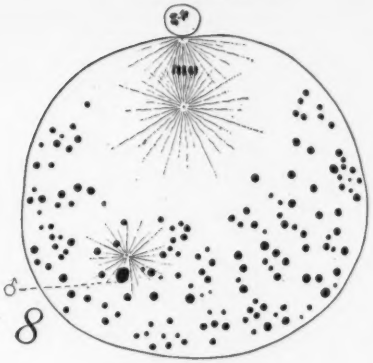

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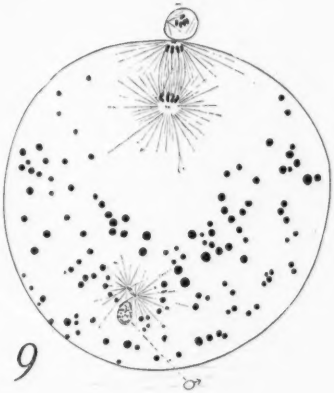

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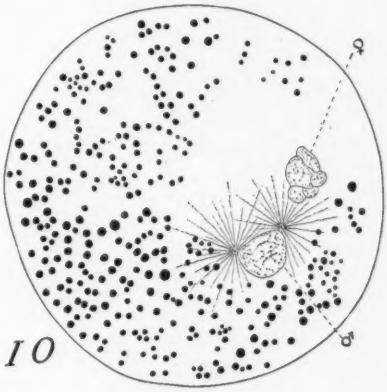

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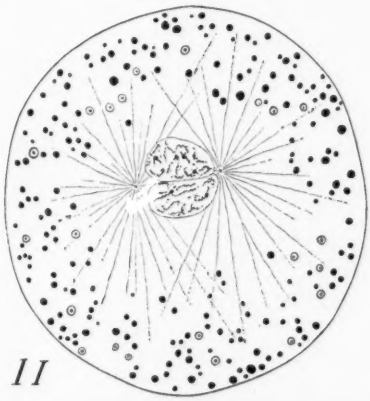

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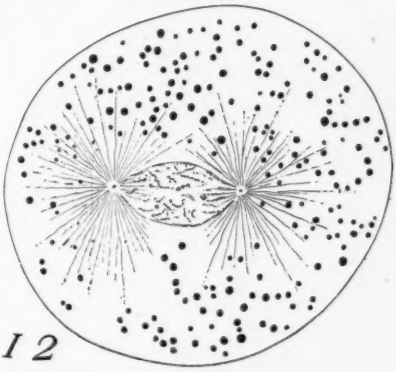


12

PLATE XV., OSTRACODA AND AGNOSTUS (part).

FIG. 1. *Lepiditta alata.* *a*, outer surface of left valve. *b*, cast of interior of right valve. Mag. $\frac{2}{1}^0$. From Div. 1 c^2, St. John, N. B. See p. 194.

FIG. 2. *Lepiditta curta.* Interior of left valve. Mag. $\frac{1}{1}^0$. From Div. 1 d^1. St. Martin's, N. B. See p. 195.

FIG. 3. *Lepiditta auriculata.* *a*, left valve showing faint concentric lines and the ligamental (?) groove at the hinge. *b*, same, hinge line in profile. Mag. $\frac{4}{1}$. From shales of Div. 1 *c*, St. Martin's. See p. 196.

FIG. 4. *Aluta flexilis* n. g. et sp. left valve (with lower margin restored) showing ocular (?) tubercle, Mag. $\frac{6}{1}$. From conglomerate limestone band in Div. 1 c^1, St. Martin's, N. B. See p. 198.

FIG. 5. *Primitia Acadica.* *a*, left valve. *b*, longitudinal section. *c*, transverse section. Mag. $\frac{6}{1}$. From Div. 1 c^1, St. Martin's, N. B. See p. 196.

FIG. 6. *Agnostus fallax* var. *vir.* Complete, somewhat flattened. Mag. $\frac{3}{1}$. From Div. 1 c^2, St. John, N. B. See p. 215.

FIG. 7. *A. fallax* var. *concinnus.* *a*, head shield. *b*, a joint of the thorax. *c*, Pygidium. Mag. $\frac{3}{1}$. From Div. 1 d^1, St. Martin's, N. B. See p. 216.

FIG. 8. Same variety. *a*, head shield of young larva retaining embyonic (Protaspis-like) features. Mag. $\frac{2}{1}^0$. *b*, young pygidium showing somites and posterior tubercle on rachis, effaced in later stages. Mag. $\frac{1}{1}^0$. Both from Div. 1d^1, St. Martin's, N. B. See p. 216.

FIG. 9. *A. fallax* var. *trilobatus*, n. var. Pygidium. Mag. $\frac{3}{1}$. From Div. 1 c^1, St. John, N. B. See p. 216.

FIG. 10. *Agnostus Acadicus*, Hartt. *a*, head shield. *b*, pygidium. Mag. $\frac{4}{1}$. From Div. 1 c^1, St. John, N. B. See p. 217.

FIG. 11. *A. Acadicus* var. *declivis.* *a*, head shield. *b*, pygidium. Mag. $\frac{4}{1}$. *c*, larval pygidium showing embryonic features. Mag. $\frac{1}{1}^5$. *d*, adult pygidium in the rachis of which are six somites. Mag. $\frac{6}{1}$. All from Div. 1 d^1, St. Martin's, N. B. See p. 219.

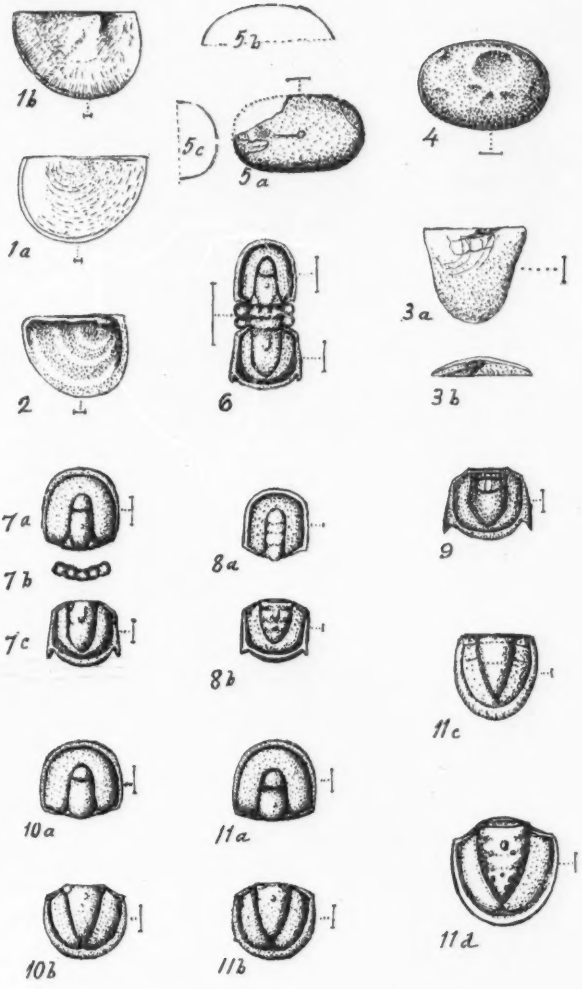

1b
5b
5c
5a
4
1a
3a
2
6
3b
7a
8a
9
7b
7c
8b
11c
10a
11a
10b
11b
11d

PLATE XVII., AGNOSTUS AND MICRODISCUS.

FIG. 1. *Agnostus lævigatus*, Dalm., var. *terranovicus*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{4}{1}$. From Div. 1 d^2, Highland Cove, Newfoundland. See p. 233.

FIG. 2. *A. lævigatus* var. *mammilla*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{4}{1}$. From Div. 1 d^2, Highland Cove, Newfoundland. See p. 235.

FIG. 3. *A. lævigatus* var. *ciceroides*, n. var. *a*, head shield. *b*, pygidium. Mag. $\frac{4}{1}$. Found with the preceding. See p 234.

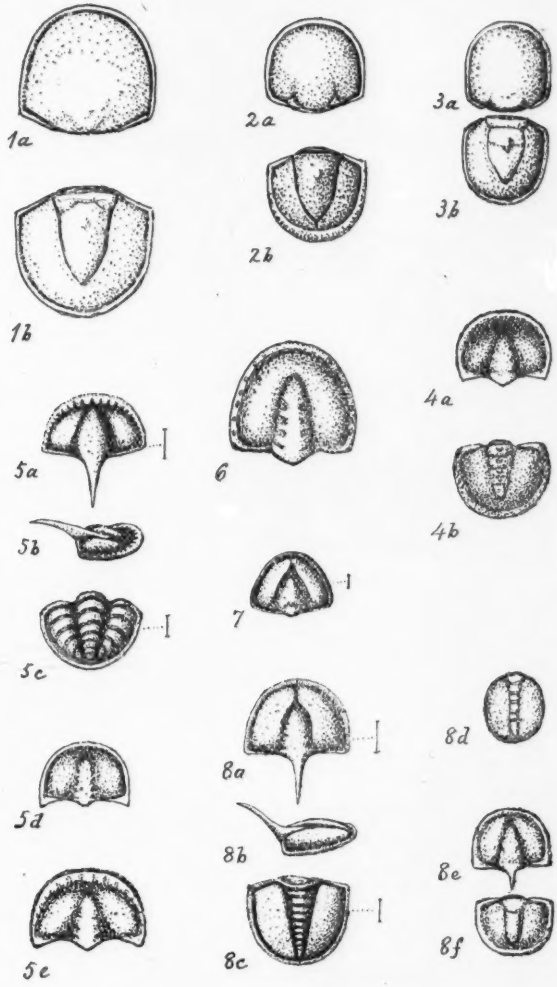
FIG. 4. *Microdiscus Schucherti* n. sp. *a*, head shield. *b*, pygidium. Mag. $\frac{4}{1}$. From Olenellus limestone, Troy, N. Y. See p. 238.

FIG. 5. *Microdiscus Dawsoni*, Hartt. *a*, head shield. *b*, same in profile. *c*, pygidium. Mag. $\frac{4}{1}$. *d*, young larval stage, head shield. Mag. $\frac{10}{1}$. *e*, next larval stage, head shield. Mag. $\frac{10}{1}$. All from Div. 1 e^1, St. John, N. B. See p. 240.

FIG. 6. *Microdiscus speciosus*, Ford. head shield. Mag. $\frac{4}{1}$. From Olenellus limestone, Troy, N. Y., figured for comparison. See p. 236.

FIG. 7. *Microdiscus precursor*. Head shield. Mag. $\frac{5}{1}$. From Div. 1 c^2, St. Martin's, N. B. See p. 239.

FIG. 8. *Microdiscus pulchellus* Hartt. *a*, head shield. *b*, same in profile. *c*, pygidium. Mag. $\frac{4}{1}$. *d*, embryonic or Protaspis stage. Mag. $\frac{20}{1}$. *e*, early larval stage. *f*, pygidium of same. Both Mag. $\frac{20}{1}$. All from Div. 1d^1, St. Martin's, N. B. See p. 242.

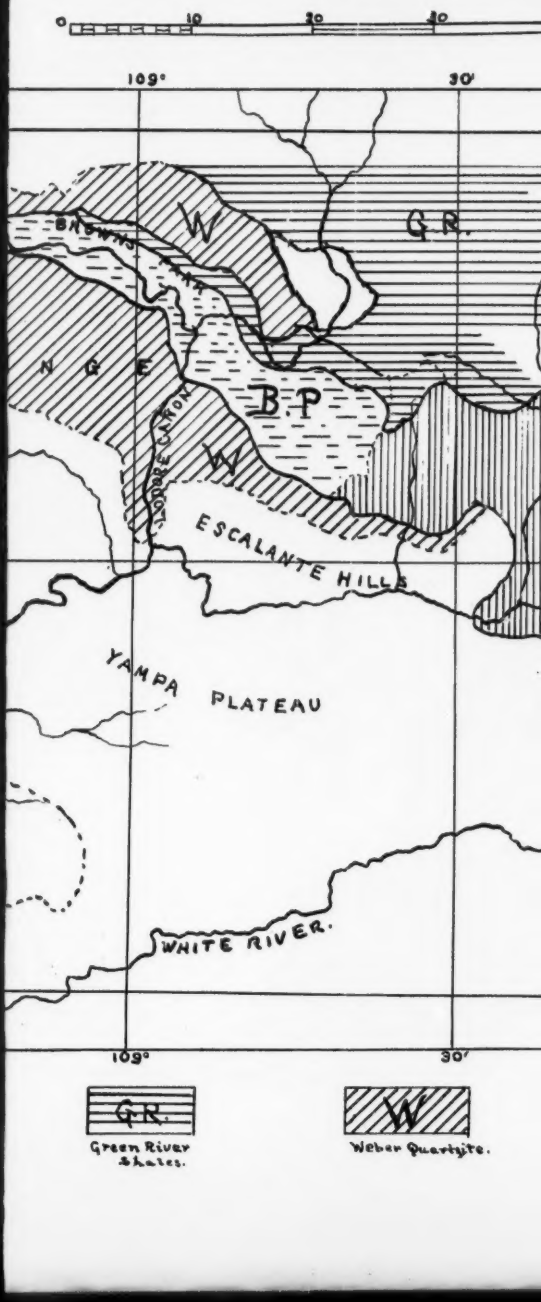

1a
1b
2a
2b
3a
3b
4a
4b
5a
5b
5c
5d
5e
6
7
8a
8b
8c
8d
8e
8f

Explanation of Plate.

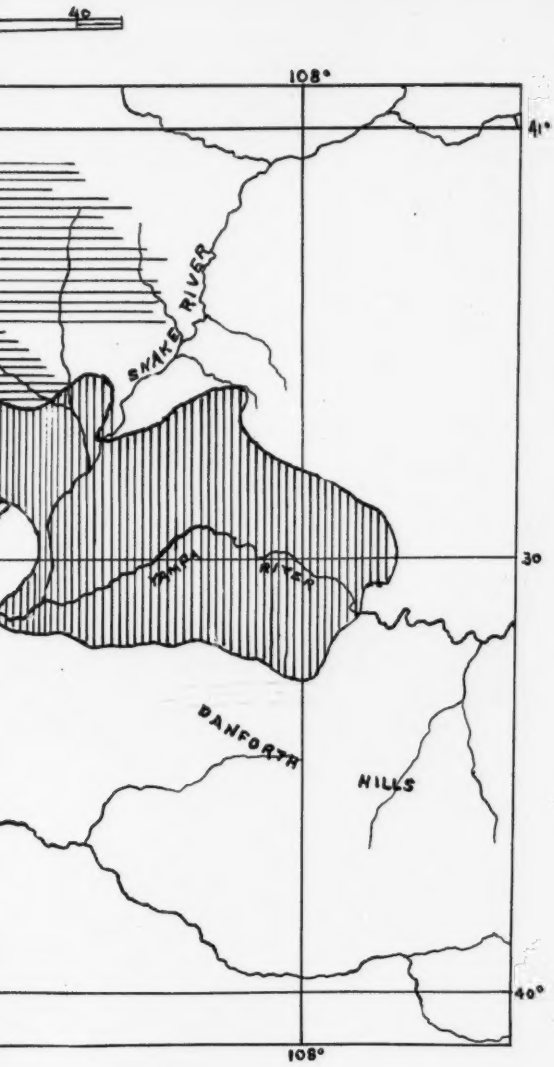
Plate XVIII. Geological Maps of the Region about Brown's Park, Utah. The geography is based on the map by C. A. White, in the Ninth Annual Report of the Director of the U. S. Geological Survey.

MAP of BROWNS P

MAP of BROWNS PARK.



PARK.



Possible Extension of Brown's Park.

New York Academy of Sciences.

FOUNDED IN 1817.

ORGANIZATION.

The Academy is fourth in point of age among the American scientific societies. It was organized in 1817 as the Lyceum of Natural History, and the present title was adopted in 1876. The constitution and organization are designed to make the Academy broadly representative of Science. The meetings and publications of the Academy are therefore open to all departments of scientific research.

The former Presidents have been: Dr. Samuel L. Mitchill, 1817–1823. Professor John Torrey, 1824–1826; 1836. Major Joseph Delafield, 1827–1837; 1839–1865. Professor Charles A. Joy, 1866–1867. Professor John S. Newberry, 1868–1892. Professor O. B. Hubbard, 1892–1893. Dr. H. Carrington Bolton, 1893–1894. Professor John K. Rees, 1894–1896.

MEMBERSHIP.

Honorary Members are limited to fifty in number, and are elected from the representative scientific men of the world. Corresponding Members are also chosen from distinguished men in different parts of the world who engage in the prosecution of some branch of research, the results of which they are expected to communicate to the Academy from time to time. This list now includes over 300 names.

Fellows are chosen from among the Resident Members, in recognition of scientific attainments or services; they form the Council and the main working body, and conduct the business of the Academy.

5. Electrographs of Coins taken in the dialectric of a condensor.
6. Photograph of bottom of developing tray broken in a dark room, upon plates which had been exposed to "Röntgen" rays.
7. Radiographs of a Key taken at more than six feet from vacuum tube.

17. ARC LAMP FOR PHOTOGRAPHY, which operates under conditions of absolute steadiness for all photographic purposes.

18. SCREEN FOR DIFFUSING LIGHT, assuming many different shapes by a touch.

Nos. 17 and 18 exhibited by the International Lamp Co.

GEOLOGY.

F

IN CHARGE OF J. J. STEVENSON.

1. Suite of ORES, ROCKS and PHOTOGRAPHS from Cripple Creek, Colorado. Exhibited by Prof. J. F. Kemp. The ore deposits are oftenest associated with dikes of phonolite or nepheline-basalt that penetrate the red granite of the Pike's Peak region, or a decomposed breccia of andesite. They also line in veins which fill more or less irregular fissures in the andesite breccia away from dikes. The ores are fresh or decomposed telluride of gold.

   This district was described before the Academy, February 7, 1896.

2. Suite of ORES, ROCKS and PHOTOGRAPHS from the Bertha and Wythe Zinc mines, in southwest Virginia. Exhibited by Prof. J. F. Kemp. The Siluro-Cambrian limestone has been originally charged with zinc blende and pyrites at the Bertha mines, and with these and galena at the Wythe mines. It has decomposed, leaving a residual

clay. The zinc blend has yielded calamine, a hydrated silicate of zinc, that has leached down and formed incrustations on the undecomposed limestone.

These mines were described to the Academy November 18, 1895.

3. Suite of SPECIMENS from Essex County, N. Y., showing the development of crushed and brecciated rocks and gneisses from originally massive igneous forms. Exhibited by Prof. J. F. Kemp. The specimens are the labradorite rock and gabbros from the Adirondacks. No. 1 shows a massive, coarsely crystalline aggregate of dark crystals of labradorite from Lake Sanford; in No. 2 and following numbers the minerals are more and more crushed until only a pulp of the original rock is left in No. 13. Nos. 14–19 show the development of gneissoid forms; Nos. 20 and following exhibit the passage of massive gabbro into hornblende gneiss. The changes were brought about by dynamic metamorphism.

4. Series of ROCK SPECIMENS, MAPS and PHOTOGRAPHS illustrating the geology of Mount Desert Island, Maine, and vicinity. Exhibited by Theodore G. White, Geological Department, Columbia University.

This embraces the original metamorphosed, unfossiliferous slates, through which the following rocks were ejected: The red granite, forming the central core of the island; rhyolites, varying in type and structure; representatives of a few of the dikes; ores and associated rocks from the Blue Hill and Cape Rosier, Maine, copper mines; contorted quartzose schists from Blue Hill.

5. Set of ROCKS from the southern portion of the Boston Basin, Mass., collected by Prof. W. O. Crosby. Exhibited by Theodore G. White.

This series embraces the *Paradoxides* slates of Braintree; the Quincy hornblendic granite; biotitic granite; diorites and dioritic granites; flow and porphyritic

146. RUTILE in QUARTZ, San Francisco Riv., Brazil. "Flèches d' amour." Very fine.

147. SPHÆROSTILBITE, Oregon.

148. CHABAZITE, Oregon.

149. THOMPSONITE, Oregon.

150. HALITE, Nr. Borax Lake, Calfornia. A suite of twelve transparent cubo-octahedral crystals.

151. HALITE, Nr. Borax Lake, California. Two groups of pale yellow and pink cubic crystals showing peculiar cavernous faces.

152. THENARDITE, Nr. Borax Lake, California. Two groups of unusually large crystals.

152. HANKSITE, Nr. Borax Lake, California. Group of very large, brilliant crystals.

154. DYSANALYTE, brilliant black crystals in gangue.

155. OPAL, Washington State. Green mottled with red. Three specimens, one of which is polished; from a new locality.

156. ENDLICHITE, Lake Valley, New Mexico. A rare variety of vanadinite in which arsenic has replaced half of the vanadium.

Nos. 140 to 156, forty-eight specimens, exhibited by Dr. A. E. Foote (W. M. Foote, Mngr.), Philadelphia.

156. TURQUOISE, Cerro de Potosi, Bolivia. Three pseudomorphs after orthoclase, simple and twinned.

158. PYRITE, Cerro de Potosi, Bolivia. Two pseudomorphs after orthoclase.

Nos. 157, 158 exhibited by Frederick A. Canfield, Dover, N. J.

PHYSIOGRAPHY.

H

In Charge of R. E. Dodge.

1. A collection of the best and more recent scientific school and college text-books on the subject of Physiography. Loaned by the publishers.
2. A collection of relief models loaned by E. E. Howell, maker, Washington, D. C.
   - *a*. Topographical model of the United States and adjacent ocean bottoms, showing curvature of the earth.
   - *b*. The same showing influence of physical features of the United States on the distribution of rainfall.
   - *c*. Topographic model of the State of Connecticut.
   - *d*. Topographic model of New Jersey.
   - *e*. The same colored to show the relation of the geology to the physical features.
   - *f*. Topographic model of the vicinity of Chattanooga, Tenn.
   - *g*. The same to show the relation of geology to physical features.
3. A collection of illustrative models for use in teaching.
   - *a*. Three models showing stages of development of topography in the down cutting of streams on a coastal plain.
   - *b*. Two models showing effects of depression and elevation upon a land well worn down previously.
   - *c*. Three models showing development of form and drainage in a region made by faulting, as in lava blocks of Oregon.
   - *d*. Two models showing effect upon topography and drainage of the oncoming of a glacier.
   - *e*. Six models showing development of topography and drainage in a land made by volcanic action and